HCL Digital Experience

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Performance Tuning Guide, December 2019

HCL Digital Experience

About This Document

This white paper provides a basis for parameter and application tuning for HCL Digital Experience 8.5 and higher releases (formerly IBM WebSphere Portal and IBM Web Content Manager).

Both tuning and capacity are affected by many factors including the workload scenario and the performance measurement environment. For tuning, the objective of this paper is not necessarily to recommend specific values, but to make readers aware of the parameters used in the Portal performance benchmarks.

Performance tuning is an iterative process. More than one change may be required to reach the desired performance of the system(s) under test. When tuning, it is important to begin with a baseline and monitor performance metrics to determine if any parameters should be changed. When a change is made, another measurement should be made to determine the effectiveness of the change. Ideally, only one change should be made between each measurement so the specific benefit of each tuning parameter can be determined.

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Performance Tuning Overview

Tuning an HCL Digital Experience (DX) environment involves tuning and configuring the various systems and components of the environment. This chapter discusses some general concepts and details the specifics of the configuration used in our measurement environments. These specifics entail:

- Configuring the application server and the resources defined for that application server
- Tuning the database(s) and database server
- Tuning the directory server and its database
- Tuning the web server and/or proxy server
- Tuning the operating system and network stack
- Tuning the HCL DX services to ensure sufficient bandwidth to support the required user load
- Performance is acceptable even on slower, long distance networks

When tuning specific systems, it is important to begin with a baseline and monitor performance metrics to determine if any parameters should be changed. When a change is made, another measurement should be made determine the effectiveness of the change.

In addition to the tuning changes we made in our measurement environments, there are some additional tuning options available which can improve performance in certain circumstances; these will be discussed in the Other Tuning Considerations section.

Using This Document

A ConfigEngine tuning task was added in Portal 8.0.0.1 CF 6 and ships out of the box with HCL Portal 8.5. This task automatically applies some, but not all of the tuning changes discussed in this document. This includes basic tuning of the JVM Max heap & nursery sizes, JDBC & WebContainer ThreadPools and CacheManagerService properties.

The tuning task also configures Portal as a rendering server by setting deployment.subscriberOnly=true and turning off the toolbar. This can be changed for Authoring environments by editing the task's properties files.

This task should be run as the first step for tuning a Portal server. See https://help.hcltechsw.com/digital-experience/9.5/install/wp_tune_tool.html for information on how to configure and run this task.

If additional tuning is necessary, start by applying the Base Portal Tuning then apply the tunings that are specific to the use case. For example, if you are using Web Content Management (WCM) also apply the WCM tunings.

The tunings in this document are applicable to HCL Digital Experience version 8.5 and higher releases.

Environment Recommendations

Before beginning your install of HCL Portal and Web Content Manager, you should consider how the environment will be used to achieve ideal performance.

64 Bit versus 32 Bit

For Portal 8.5, 32 bit JVMs are no longer supported. All measurements were run with 64 bit operating systems running 64 bit versions of IBM WebSphere and HCL Portal and WCM.

Hardware Multithreading

Many modern processor architectures support hardware multithreading. For example, this is known as Hyper-Threading (HT) on Intel processors and Simultaneous Multithreading (SMT) on Power processors. Our experience is that using hardware multithreading provides an improvement in capacity in all of the scenarios and platforms we have measured, so we would recommend its use on platforms where this is an option.

Virtualization

When running Portal in a virtualized environment, it is important to ensure that the virtual machines are allocated enough resources to perform optimally. To reach capacity on a virtual machine (VM) it may be necessary to ensure that the virtual resources map one-to-one with physical resources, especially CPU and memory. Running Portal on a VM whose host is overcommitted will not achieve optimal performance. Consider dedicating CPUs and memory to the Portal VMs.

In addition, ensure that the network bandwidth to the host is sufficient for all VMs. Depending on requirements, the Portal VM may require a dedicated network interface on the host.

Portal Topologies

HCL Portal supports a variety of deployment topologies. Typical deployments will use a three-tier configuration:

- HTTP server(s)
- Application server(s)
- Database and directory server(s)

The primary benefit of having a multi-tiered configuration is to avoid resource contention brought on from multiple databases and applications residing on a single server. For example, if the database server shares a node with the application server, the combined resource contention would negatively impact the amount of throughput that can be achieved. On the other hand, a small deployment may have sufficiently small resource requirements that some of these servers could be deployed on a single node.

A multi-tiered configuration also allows a single component to be scaled up by adding extra servers. Portal servers, for instance can be added to increase capacity without also requiring a new database installation and configuration.

Single-Server Topology

For smaller deployments, some of these tiers may be run on a single system. For example, a common configuration is to use a single node to run the HTTP server and the application server, while the database and directory servers are run on separate servers. This is the configuration we have used for most performance benchmarks. The only exception to this was on newer, more powerful Windows systems. In that case, Portal was able to support so many simultaneous users, that an outboard-64 bit HTTP server was required.

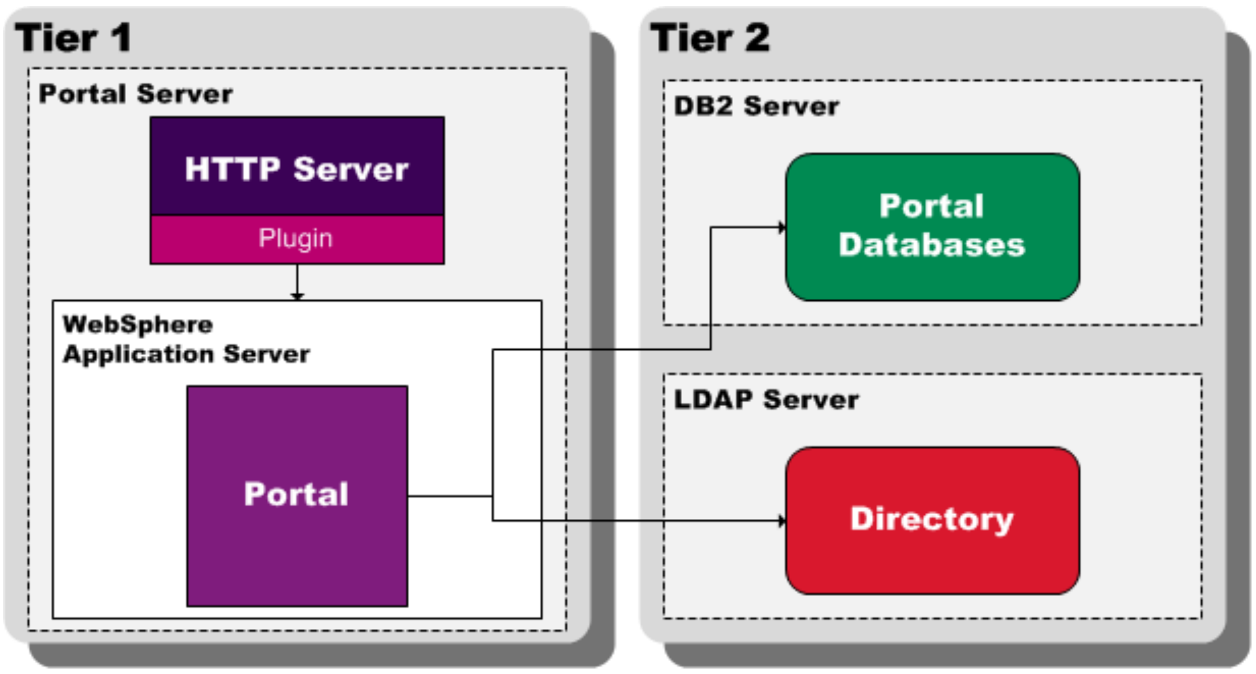


Figure 1 Portal Single Server Topology

Cluster Topology

A cluster deployment has one or more nodes in the application server tier. The cluster configuration we used in our lab, shown in the diagram below, is as follows:

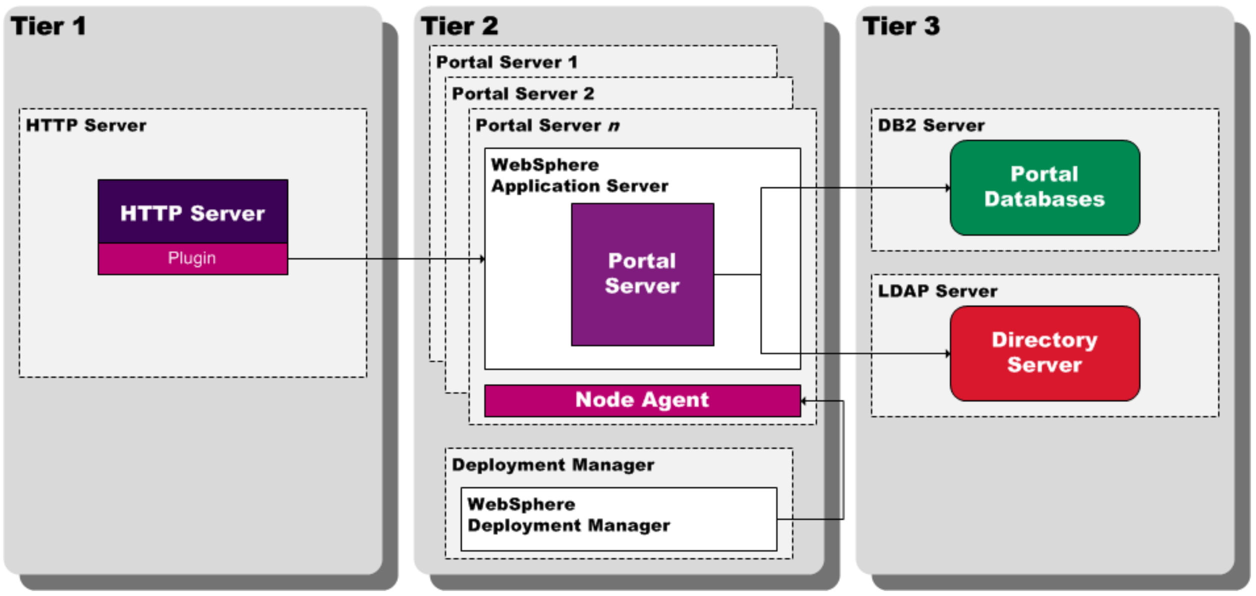


Figure 2 Portal Cluster Topology

The first tier is a web server. We used the WebSphere plugin for load balancing. The incoming client HTTP requests are routed by the plugin to a cluster of Portal servers using the random load balancing algorithm.

Many clustered deployments will use multiple HTTP servers with a load balancer directing traffic to those servers. This will provide additional capacity at the HTTP servers as well as server failover support at the HTTP layer.

The second tier includes the Portal servers and the Deployment Manager. The Portal servers execute portlets and other application logic to handle the client requests. The Deployment Manager coordinates all Portal server processes through a node agent process running on each node. This diagram depicts a horizontal cluster where each Portal server runs in a separate operating system. Portal also supports a vertical clustering topology where multiple Portal servers run on a single operating system. Vertical clustering was not measured in performance benchmarks because 64-bit JVMs are capable of utilizing all the CPU resources of systems with at many as 12 cores.

Incoming HTTP requests from the web server (tier 1) were routed to one of Portal server nodes using the WebSphere plugin. With session affinity, the plugin will attempt to route all requests associated with a particular session (end user) to the same node.

The third tier includes the LDAP server and Portal databases. These servers store the user directory information about Portal resources such as pages & portlets and WCM content.

Base Portal Tuning

There are many aspects to configuring and tuning an application server in WebSphere Application Server. The aspects presented here are critical to an optimally performing WebSphere Portal in our benchmark environment.

The base Portal Scenario covers user login, page navigation and interaction with simple portlets. Users can see a set of pages which are visible to all authenticated users. Another set of pages, based on LDAP group membership, is also configured.

We have also benchmarked a number of other scenarios, which focus on different functions or use cases for WebSphere Portal. There are scenarios which make use of Web Content Management (WCM) and page management. In previous versions of Portal a scenario where users have access to thousands of pages was also measured. While we have used different values to optimize performance for some of those scenarios, the tuning is all based on the tuning detailed in this section.

The “Portal 8.5 Theme” is the theme that ships with version 8.5. That is the only theme discussed in this tuning document. Tuning for themes from previous releases are discussed in the Tuning Guides specific to that release.

In our measurement environments, we typically use a separate database server and directory server, in addition to the HCL Portal server. We run these servers on separate systems to avoid resource contention on the system running the HCL Portal server. This helps improve the total capacity of the Portal server. The measured topology corresponds to the configuration shown in Figure 1 Portal Single Server Topology.

Tuning via the Integrated Solutions Console

To get to WebSphere Integrated Solutions Console, start WebSphere Portal and then login to the WebSphere Integrated Solutions Console via https://{yourserver}:10041/ibm/console with the administrator user ID created during Portal installation.

The port number, 10041, is the port number in our lab deployments, but other deployments may use different ports. To find out the ports in use for your installation, look for 'adminhost' in <wp_profile root>/config/cells/<cell_name>/ nodes/<node_name>/serverindex.xml.

For more details on configuring a WebSphere Application Server, see the Tuning Section of the Information Center located at https://www.ibm.com/support/knowledgecenter/en/SSEQTP_9.0.5/as_ditamaps/was9_welcome_base.html

JVM Tuning

Heap Size

When setting the heap size for an application server, keep the following in mind:

- Make sure that the system has enough physical memory for all of the processes to fit into memory, plus enough for the operating system. When more memory is allocated than the physical memory in the system, paging will occur and this can result in very poor performance.
- After doing any tuning of heap sizes, monitor the system to make sure that paging is not occurring.
- We set the minimum and maximum heap sizes to the same values since we're using the generational, concurrent (or 'gencon') garbage collection which helps avoid heap fragmentation. Generational concurrent garbage collection has given the best throughput and response time results in our measurements.
- Note that running clustered WebSphere nodes may require larger heap sizes compared to standalone, non-clustered systems if session replication is being used. This is especially true if using memory-to-memory session replication since session information is also stored in the JVM.

After doing any heap size tuning, monitor the verbose garbage collection output to determine if the selected size is appropriate. Ideally, the system should spend no more than 10% of its time in garbage collection. To understand verbose garbage collection output, refer to Memory Analysis section in the WebSphere documentation:
https://www.ibm.com/support/knowledgecenter/en/SSEQTP_9.0.5/as_ditamaps/was9_welcome_base.html

In HCLPortal, the maximum heap size is highly dependent on cache tuning values. In general, the larger the caches, the better performance will be. Larger caches, however, use more JVM heap.

The values used in performance benchmarks, detailed below, are set primarily to allow larger cache sizes, not because the measured portlets use significant amounts of memory. These values are related to the hardware configuration and the total throughput each can support. They do not reflect the absolute limits of each architecture. Values will need to be tuned based on specific hardware and application configuration, especially the throughput and number of active users required.

Table 1 Base Portal Maximum JVM Heap Sizes

AIX	Windows	Linux
3584	3584	Not Measured

How to Set

In the WebSphere Integrated Solutions Console

Servers → Server Types → WebSphere application servers → WebSphere_Portal → Server Infrastructure: Java and Process Management → Process Definition → Java Virtual Machine

Initial Heap Size
Maximum Heap Size

Large Pages

Large pages can reduce the CPU overhead needed to keep track of the heap. With this setting we have seen as much as a 10% throughput improvement in our measurements.

Be aware that any allocation of large pages is reserved upon boot and only available to applications requesting large pages. Consider the following when using large pages:

Adjust values to match the maximum heap size of the JVM. Enough large pages must be allocated to hold the entire JVM heap plus native code.
Be careful in your settings to ensure there is enough memory still available to other application, especially the OS.
In some or the measured environments, more large page space was allocated than strictly required for the JVM maximum heap size. If a system is low on memory more tuning could be performed to optimally size the large pages allocated.

Table 2 JVM Large Pages Support

AIX	Windows	Linux
-Xlp	-Xlp Requires specific privileges	-Xlp

How to Set

In the WebSphere Integrated Solutions Console

Servers → Server Types → WebSphere application servers → WebSphere_Portal → Server Infrastructure: Java and Process Management → Process Definition → Java Virtual Machine

Add -Xlp to the Generic JVM Arguments field

This setting is required to ensure that the Portal JVM requests large pages from the operating system. To verify that large pages are being used, ensure that the requestedPageSize and pageSize attributes are the same in the verbose:gc output.

Note that on some Unix implementations you may be required to start HCL Portal as 'root' after enabling large page support. On Windows, Portal may need to be run with Administrator rights for large pages to work properly and the Windows user must have the "Lock Pages in Memory' permission enabled.

See the -Xlp section in the Java Diagnostics guide for more information on this setting – http://www-01.ibm.com/support/knowledgecenter/SSYKE2_7.0.0/com.ibm.java.aix.70.doc/diag/appendixes/cmdline/Xlp.html.

AIX

AIX operating systems must be configured to support large pages.

How to Set

1. Add the -Xlp option as described above.
2. Allocate 4.5GB of RAM as large pages of 16MB each. Reboot the system.
   ```
   vmo -r -o lgpg_regions=288 -o lgpg_size=16777216
   bosboot -ad /dev/ipldevice
   reboot -q
   ```
3. After the reboot completes, enable large page support. This setting persists across reboots.
   ```
   vmo -p -o v_pinshm=1
   ```
4. If Portal is running under a non-root user id, you need to grant large page usage to that user.
   ```
   chuser capabilities=CAP_BYPASS_RAC_VMM,CAP_PROPAGATE <user>
   ```
5. Restart the Portal Server.

To verify if large pages are being used, run the AIX command vmstat -l 1 5. Check the alp column, which is the number of active large pages used. It should be a non-zero value if large pages are being used.

In addition, changing to 64K page size for text (TEXTPSIZE) and stack (STACKPSIZE), and 16MB page size for data area (DATASIZE) gives the best performance.

How to Set

In the WebSphere Integrated Solutions Console
Servers → Server Types → WebSphere application servers → WebSphere_Portal → Server Infrastructure: Java and Process Management→Process Definition→ Environment Entries → New

Name: LDR_CNTRL
Value: STACKPSIZE=64k@TEXTPSIZE=64k@DATAPSIZE=16MB

Linux

Large pages are supported by systems running Linux kernels version 2.6 or higher. Note that Linux refers to large pages as 'Huge Pages'. This should not be confused with the Huge Pages in AIX, which are much larger.

For performance benchmarks, 2,048 Huge Pages are configured. Each HP is 2MB in size, so 4GB is reserved upon boot. This memory is available only to apps configured to use it. This is enough memory to store the entire JVM heap in Huge Pages.

How to Set

1. Add the -Xlp option as described above.
2. Allocate 4GB of RAM by placing the following line in the /etc/sysctl.conf file:
   ```
   vm.nr_hugepages=2048
   ```
3. If Portal is running under a non-root user id, the memory lock limit for the user or group will need to be increased to the maximum heap size of the JVM. This can be done with the ulimit command or by adding the following to /etc/security/limits.conf:
   ```
   @<large group name> soft memlock 2097152
   @<large group name> hard memlock 2097152
   ```
4. Reboot the system

You can check the current status by issuing the following command: grep Huge /proc/meminfo.

On our benchmark system the above command results in the following (when Portal is not running):

```
HugePages_Total: 2048
HugePages_Free: 2048
HugePages_Rsvd: 0
Hugepagesize: 2048 KB
```

For non-root users, it may be necessary to include the user as a member of the hugetlb_shm_group as documented here:

https://www-01.ibm.com/support/knowledgecenter/SSYKE2_7.0.0/com.ibm.java.lnx.70.doc/user/alloc_large_page.html

Windows

How to Set

1. Add the -Xlp option as described above.
2. Give the user that runs the WebSphere process permissions to Lock pages in memory. See http://msdn.microsoft.com/en-us/library/ms190730.aspx for more information. Windows must be restarted for this change to take effect.

Nursery Size

When using the generational garbage collector, the JVM will automatically split the heap between the nursery (where new objects are allocated) and the tenured region (where long-lived objects reside). However, we found that the JVM tended to under-size the nursery, and that we were able to increase overall throughput by overriding the automatic sizing of the nursery.

How to Set

In the WebSphere Integrated Solutions Console
Servers → Server Types → WebSphere application servers → WebSphere_Portal → Server Infrastructure: Java and Process Management→Process Definition → Java Virtual Machine

Add -Xmnxxxm to the Generic JVM Arguments, where xxx is the size in MB.

Table 3 JVM Nursery Sizes

AIX	Windows	Linux
1024	1024	1024

The higher nursery size on Windows reflects the higher maximum heap size used on that platform. Larger JVM heaps often perform better with larger nursery sizes.

Shared Class Cache Size

Class sharing in the IBM JVM offers a transparent and dynamic means of sharing all loaded classes, both application classes and system classes. More information about this feature is given in the IBM Java Diagnostics Guide. From the point of performance, this can reduce the startup time for a JVM after the cache has been created. It can also reduce the virtual storage required when more than one JVM shares the cache.

WebSphere Application Server enables class data sharing by default, and sets the size of this cache to950MB. Many HCL Portal applications will have more than 90MB of shared-class data, so an additional benefit can be achieved by increasing this cache size. We found that about 75MB was in use after starting Portal, so we used a shared class cache size of 150MB to allow room for additional applications. We also saw that by increasing the size of the shared class cache, our performance results were more repeatable across multiple measurements, particularly on AIX.

The shared class cache persists until it is destroyed, thus you must destroy it first if you want to change its size.

Note that the shared class cache is shared for all WebSphere JVMs on the same server. This includes the WebSphere Deployment Manager (DMGR) and node agent JVMs. To properly change the cache size in cluster configurations, the node agent and the DMGR (if on the same server as Portal) need to be stopped before the cache is destroyed. The cache size setting should be also made on the node agent and DMGR in addition to Portal so that starting the DMGR and node agent do not override the Portal server setting.

How to Set

1. In the WebSphere Integrated Solutions Console
   Servers → Server Types → WebSphere application servers → WebSphere_Portal → Server Infrastructure: Java and Process Management→Process Definition → Java Virtual Machine
   Add -Xscmxnnnm to the Generic JVM Arguments field, where nnn is the size in MB.
2. Stop Portal server
3. Under <AppServer root>/java/bin, run the following command. Note that the name of the shareclasses changes depending upon platform and release. To determine the name you need to use, search the verbose GC log (native_stderr.log) and look for Xshareclasses:name=
   - AIX: ./java -Xshareclasses:name=webspherev85_1.7_64_%g,groupAccess,destroy
   - Windows: java -Xshareclasses:name=webspherev85_1.7_64,groupAccess,destroy
   - Linux: ./java -Xshareclasses:name=webspherev85_1.7_64%g,groupAccess,destroy
4. Look for the message
   JVMSHRC010I Shared cache "webspherev85_xxx" is destroyed. Could not create the Java virtual machine.
5. Start Portal Server
6. Check cache size in use
   - AIX: ./java -Xshareclasses:name= webspherev85_1.7_64_%g,groupAccess,printStats
   - Windows: java -Xshareclasses:name= webspherev85_1.7_64_%g,groupAccess,printStats
   - Linux: ./java -Xshareclasses:name= webspherev85_1.7_64%g,groupAccess,printStats

Table 4 JVM Shared Class Cache Sizes

AIX	Windows	Linux
150	150	150

MaxDirectMemorySize

This JVM parameter sets an upper bound on the amount of native memory (not Java heap memory) that can be allocated through the DirectMemoryAllocation API, which is most commonly used for DirectByteBuffers. These buffers are used in I/O operations, including network sends and receives. This parameter should be treated as "tunable". Any optimum value is going to be deployment, application and workload specific.

If this parameter is not specified, then there is no hard upper limit on the size of this memory. The native memory for these buffers is automatically adjusted upward by the JVM as needed by the application. Before growing the physical memory allocation, however, the JVM aggressively attempts to reclaim memory (to avoid new allocations) by performing one or more System garbage collections (GCs). These System GCs may cause undesirable latency behavior in the system since application threads are paused during any GC operation.

If this parameter is specified, two things change:

1. The specified value is treated as a 'hard limit' by the JVM. If the application requests DirectMemory which would exceed the limit, the JVM will attempt to free memory by performing System GC(s), in the same way if the limit was not specified. However, if the system is still unable to satisfy the memory allocation request, then because the specified limit is 'hard', the JVM throws an OutOfMemoryError, with a log message indicating the reason and suggesting adjustment of this parameter (java.lang.OutOfMemoryError: Direct buffer memory::Please use appropriate '<size>' via -XX:MaxDirectMemorySize=<size>.)
2. Our observations indicate that with this setting explicitly specified, the system avoids performing any system GC cleanup before growing the amount of physical memory allocated for these buffers (assuming that the allocation is still under the hard limit). Specifically, for the heavy load scenarios where these pause times were significant, this can be helpful.

If the application environment can tolerate intermittent high latency, then you may get acceptable throughput and response times by not specifying this parameter at all. But under heavy load, when Portal CPU utilization approached 80%, we have observed those delays to be higher than one minute. If you expect your system to be very heavily loaded and such GC events with the resulting delays would be undesirable, then we recommend setting this parameter to a 'large enough' value to accommodate the DirectMemory requirements of your environment. Determining what is 'large enough' requires testing with the closest possible approximation of the actual peak workload, with real-world data that would be used in a production deployment. Various tests with different workloads in WebSphere Portal yielded results that lead to the recommendations in this section. There is not necessarily one optimum setting for all cases.

The initial allocation of physical memory for these buffers is 64MB. This initial allocation size is currently not tunable.

Monitoring

Especially as the maximum allocation size is increased, the overall Java process size should be monitored to ensure that the server's physical memory is not being overcommitted which would cause paging. The process size should also be monitored to make sure it is not growing over time; this could indicate a memory leak. See https://www.ibm.com/developerworks/community/blogs/kevgrig/entry/tracking_directbytebuffer_allocations_and_frees_in_ibm_java for more information.

Tested Values

In the majority of our measurements with WebSphere Portal, the best results were obtained by explicitly specifying a maximum value. For most workloads, the use of -XX:MaxDirectMemorySize=256000000 was sufficient. However, using 1G had no adverse effects as our systems had adequate memory for the Portal process. The one measurement in Portal testing where the above setting was inadequate was the Web Application Bridge scenario (WAB) when fetching 1MB pages. At very high transaction rates, this drove so much I/O throughput that we had to use a value of 1000000000 (1 GB) in order to allow the JDK to have enough direct memory to support the demands we were placing on it.

Again, it is best to try to determine a value for this parameter by simulating a very high transaction rate with "real world data" in a test environment.

As of Portal 8, MaxDirectMemorySize can be specified using a shorthand notation. For example -XX:MaxDirectMemorySize=1G will set it to 1 gigabyte. If there is sufficient real memory on the server, there is no penalty for specifying -XX:MaxDirectMemorySize=1G and that value will avoid the out of direct memory condition for most workloads.

How to Set

In the WebSphere Integrated Solutions Console
Servers → Server Types → WebSphere application servers → WebSphere_Portal → Server Infrastructure: Java and Process Management→ Process Definition → Java Virtual Machine
Add -XX:MaxDirectMemorySize=1G to the Generic JVM Arguments field.

com.ibm.websphere.alarmthreadmonitor.threshold.millis

The Portal log may contain the following warnings after a long period of heavy usage:

```
000000f3 AlarmThreadMo W  UTLS0008W: The return of alarm thread "Non-deferrable Alarm : 2" (0000003b) to the alarm thread pool has been delayed for 32480 milliseconds. This may be preventing normal alarm function within the application server.
```

These messages are spurious and can be disabled by setting a JVM argument. See http://www-01.ibm.com/support/knowledgecenter/SS7K4U_8.5.5/com.ibm.websphere.nd.multiplatform.doc/ae/ttrb_confighangdet.html?cp=SSAW57_8.5.5 for more information.

How to Set

Add the following to the Generic JVM arguments:
-Dcom.ibm.websphere.alarmthreadmonitor.threshold.millis=xxxxx where xxxxx is greater than the number of milliseconds mentioned in the error message. We used as much as 40,000 in our runs.

Native Memory

Java uses native (non-heap) memory to store data about loaded classes, classloaders, threads, monitors and other metadata. All of this metadata must fit in the first 4GB of memory for the process. If there is insufficient space for additional metadata to be allocated, then a native OutOfMemoryError (NOOM) will be thrown. In general, this can happen for two reasons: 1) there is a class, classloader, thread, or monitor leak, and 2) the Java heap is sharing the 0 to 4GB address space.

The first cause can be investigated using the javacore.txt file that's produced with the NOOM by searching for large numbers of these objects.

The second cause is due to default performance optimizations that Java makes with compressed memory references. If metadata demands cannot be reduced, then the starting address of JVM heap memory can be changed. To have the JVM start addressing heap objects above 4GB, set the JVM parameter -Xgc:preferredHeapBase=0x100000000. Note that this setting may cause slight performance regressions. Testing will be required to determine if this setting is optimum.

See http://www-01.ibm.com/support/docview.wss?uid=swg21660890 for more information.

Power 7

On AIX Power 7 systems, add –Xcodecache30m to the Generic JVM Arguments to allow ample space in the Java code cache.

On AIX Power 7 systems, add -XtlhPrefetch to the Generic JVM Arguments. This Generic JVM Argument prefetches bytes in the thread local heap ahead of the current allocation pointer during object allocation. It helps reduce the performance cost of subsequent allocations.

Session Timeout

The default value for the session timeout is 30 minutes. Reducing this value to a lower number can help reduce memory consumption, which allows a higher user load to be sustained for longer periods of time. Reducing the value too low can interfere with the user experience as users will be forced to log in again if their session times out.

In the base Portal performance evaluation, we use an average think time of 12 seconds between mouse clicks. That is a shorter think time than humans use when interacting with a website. To compensate for the short think time, we used a short Session Timeout of 10 minutes. This is acceptable for a performance evaluation, but is not recommended for a production environment. The proper production setting depends on business needs. Load test should be run long enough to determine the system’s behavior when the maximum number of sessions is reached.

How to Set

In the WebSphere Integrated Solutions Console
Servers → Server Types → WebSphere application servers → WebSphere_Portal → Container Settings: Web Container Settings → Session Management → Session Timeout → Set Timeout

Web Container Thread Pool Size

Set the servlet engine thread pool size and monitor the results. Increase this value if all the servlet threads are busy a significant percentage of the time.

The default minimum and maximum value of 50 was used for performance benchmarks. Fifty threads were enough to drive Portal to capacity with the portlets used in the measurement workload. Portlets which require access external systems, like databases, may require more threads.

If response times increase before CPU loads reach a high level, monitor the Web Container Thread Pool through the WebSphere PMI interface. If the thread pool is significantly utilized, the size should be increased.

How to Set

In the WebSphere Integrated Solutions Console
Servers → Server Types → WebSphere application servers → WebSphere_Portal → Additional Properties: Thread Pools→ Web Container → Thread Pool

- Minimum size threads
- Maximum size threads

We recommend setting the minimum and maximum thread pool size equal to each other. Memory leaks have been observed when these values differ. For additional discussion of this see http://www-01.ibm.com/support/docview.wss?uid=swg21368248.

Data Source Tuning

Portal uses multiple database domains to store information. Each database domain has its own JDBC data source, so when tuning in the admin console remember to tune all the data sources..

Connection Pool Size

The default settings of 10 minimum and 50 maximum were used for the connection pool sizes for the base Portal Scenario. For WCM, higher maximum connection pool sizes are needed. Higher connection pool sizes may also be needed in other cases, such as using parallel portlet rendering or if larger web container thread pool is needed. In all cases, we recommend monitoring the database connection pools and increasing their maximum sizes if the pool is completely utilized.

How to Set

In the WebSphere Integrated Solutions Console: Resources → JDBC Providers → provider name → Data Sources → data source name → Connection pool properties

- Maximum connections

- Minimum connections

If deployed applications also use database connections, ensure that the connection pool is tuned for those data sources as well.

Prepared Statement Cache Size

All data sources are configured in a similar manner. The default setting of 10 was used for the prepared statement cache size on all data sources.

How to Set

In the WebSphere Integrated Solutions Console
Resources → JDBC Providers → provider name → Data Sources → data source name → WebSphere Application Server data source properties → Statement cache size.

The provider name and data source name are based on the names selected for that database during the database transfer step.

Be aware that specifying a larger prepared statement cache size can lead to OutOfMemory errors in situations where your application memory is already being highly utilized by your workload. The prepared statement cache size setting is the maximum allowed cache entries per database connection. So increasing the cache size on a data source that has a large number of connections can quickly increase the heap utilization for these cache objects. Any changes should be considered for each individual data source independently instead of across all data sources globally. Before increasing a data source's prepared statement cache size you should monitor your memory usage under a heavy workload to determine if there is enough JVM heap available to handle an additional increase.
Finally, in some workloads, increasing the prepared cache statement size will be of no benefit. For instance, on WCM workloads, due to the dynamic nature of the SQL statements generated against the JCR database the cache size would have to be very large to cover all of the different permutations. Even at significantly larger sizes, the cache hit rate would be very low.

For additional discussion of connection pools and web container threads consult the IBM WebSphere Application Server Help Center here:
https://www.ibm.com/support/knowledgecenter/en/SSEQTP_9.0.5/as_ditamaps/was9_welcome_base.html

Security Related Fields

Security Attribute Propagation

If the WebSphere Subject has not been customized, for example through Trust Association Interceptor (TAI) or a custom WAS login module, then there is no need to enable Security Attribute Propagation. Security Attribute Propagation (SAP) can add extra overhead due to the extra processing required. However, there are certain configurations where performance might be better with security propagation enabled due to reduction of remote registry calls. See the HCL Digital Experience 8.5 Help Center https://help.hcltechsw.com/digital-experience/8.5/welcome/wp_welcome.html (search for 'security attribute propagation') for a discussion of when propagating security attributes is desirable.

If you want to enable SAP for functional reasons, you can reduce the overhead using a custom property com.ibm.CSI.disablePropagationCallerList. This will improve login performance. Adding this property and turning off SAP will give the best performance.

How to Set When Propagation Is Not Required

1. In the WebSphere Integrated Solutions Console
   Security→Global security→Web and Sip security→Single sign-on(SSO) →uncheck Web inbound security attribute propagation
2. In the WebSphere Integrated Solutions Console
   Security → Global security → Custom properties → New
   Name: com.ibm.CSI.disablePropagationCallerList
   Value: true

Avoid Refetching Static Content After Login

With the Portal 8.5 theme many resources do not change before and after logging in. These resources include the ra: collection URLs that are part of the theme. The same URL can safely be used for authenticated and unauthenticated users.

How to Set

1. In the WebSphere Integrated Solutions Console:
   Security → Global security
2. Expand Web and SIP security
3. Click on General Settings
4. Check 'Use available authentication data when an unprotected URI is accessed'
5. Save

Nested Group Cache

See the Nested Group Cache section under Other Performance Tuning of this document for a discussion of disabling nested group cache.

VMM Tuning

VMM Context Pool

Tune the VMM Context Pool to improve the performance of concurrent access to an LDAP server.

The settings specified here depend on the number of users that will be accessing Portal concurrently.

How to Set in ISC

1. In the WebSphere Integrated Solutions Console
   Security → Global security
2. Under Available realm definitions ensure Federated Repositories is selected
3. Click the Configure button
4. Click on the LDAP Repository Identifier
5. Click Performance under Additional Properties

How to Set Manually

Edit <wp_profile_root>/config/cells/<cellname>/wim/config/wimconfig.xml.

Change the contextPool settings to match the following:

```
<config:contextPool enabled="true" initPoolSize="10" maxPoolSize="40" poolTimeOut="0"
poolWaitTime="3000" prefPoolSize="40"/>
```

Table 5 VMM Context Pool Settings

Context Pool Setting	Default Value	Value Used
Initial Size	1	10
Preferred Size	3	40
Number of open connections to maintain to an LDAP server		
Maximum Size	20	40
A value of 0 allows the pool to grow as large as needed. If access to the LDAP server is shared by many systems, this setting may allow an excessive number of connections to the LDAP server; in such a case, set the maximum pool size to a value appropriate to your environment.		

The number of active LDAP connections can be monitored by viewing the number of open connections on the LDAP server via the netstat command:

```
netstat -an | grep 389 | wc -l
```

Note: If your networking configuration requires your Portal server to access the LDAP server through a proxy (such as a firewall or a load balancer) that breaks TCP connections without notifying it's endpoint, it may be necessary to modify the pool timeout to never reuse a connection past a certain age. View additional guidance on connection pooling options available from the IBM WebSphere Application Server Knowledge Center documentation:
https://www.ibm.com/support/knowledgecenter/en/SSEQTP_8.5.5/com.ibm.websphere.base.doc/ae/umj_sesspoolset.html

VMM Caches

Tune VMM search results and attributes cache to improve the performance of VMM search.

How to Set in ISC

1. In the WebSphere Integrated Solutions Console
   Security → Global security
2. Under Available realm definitions ensure Federated Repositories is selected
3. Click the Configure button
4. Click on the LDAP Repository Identifier
5. Click Performance under Additional Properties

How to Set Manually

Edit <wp_profile_root>/config/cells/<cellname>/wim/config/wimconfig.xml.

Change the attributesCache settings to match the following
<config:attributesCache attributeSizeLimit="2000" cacheSize="8000" cacheTimeOut="1200" enabled="true"/>

Change the searchResultsCache settings to match the following:
<config:searchResultsCache cacheSize="8000" cacheTimeOut="600" enabled="true" searchResultSizeLimit="1000"/>

Table 6 VMM Attribute Cache Settings

Attribute Cache Property	Default Value	Value Used
Cache size	4000	8000
Cache time out	1200	1200

Table 7 VMM Search Results Cache Settings

Search Results Cache Property	Default Value	Value Used
Cache size	2000	8000
Cache time out	600	600

Note that with VMM caching content from the LDAP server, changes made to existing LDAP entries will not be visible to Portal until the cache entries expire.

Advanced group configurations

If your LDAP supports the group membership attribute, it is recommended to configure VMM to use it to gain a performance benefit. Details on the use of this attribute and steps to configure VMM to use it can be found here:

https://help.hcltechsw.com/digital-experience/8.5/plan/plan_vmm_int.html?query=vmm

Internationalization Service Tuning

An internationalized (i18n) application can be configured to interact with users from different regions in culturally appropriate ways. The internationalization service enables you to configure and manage an internationalization context for an application.

This feature is needed by the WebSphere i18n classes. If your application code is not using the following classes, it is safe to disable this service.

- com.ibm.websphere.i18n.context.UserInternationalization
- com.ibm.websphere.i18n.context.Internationalization
- com.ibm.websphere.i18n.context.InvocationInternationalization

Note that Portal does not make use of these classes internally.

How to Set

In the WebSphere Integrated Solutions Console
Servers → Server Types → WebSphere application servers → WebSphere_Portal → Container Services: Internationalization service

Uncheck "Enable service at server startup".

Resource Environment Provider Properties

Note that all tunings in this section used the Integrated Solutions Console to edit Resource Environment Provider properties. The same values can be changed by editing the appropriate properties file in the PortalServer directory and running the ConfigEngine task update-properties to update the values in WebSphere. Regardless of how they are changed, the Portal server will need to be restarted for the new values to take effect.

How to Set by Editing the Property File

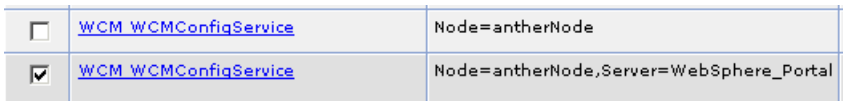
- Edit <wp_profile_root>/PortalServer/config/xxxService.properties.
- If the property is already listed, uncomment the existing line and set the desired value.
  If the property is not listed, add a new entry with the desired value.
- Run <wp_profile_root>/ConfigEngine/ConfigEngine.sh update-properties.

How to Set Default Values

To reset a property to the default value:

- In the WebSphere Integrated Solutions Console, go to the Custom Properties for the given Resource Environment Provider.
- Set the value for the property name to the default value listed in the following sections.

Note that there may be multiple Providers listed in the console. If this is the case, make sure that the properties are being updated at the *server level* (Server=WebSphere_Portal), not the node level.



☐	WCM WCMConfigService	Node=antherNode
☑	WCM WCMConfigService	Node=antherNode,Server=WebSphere_Portal

Disable Tagging and Rating

If you are not using the Tagging and Rating services they can be disabled. In our results, disabling this improved capacity by 3%.

How to Set

In the WebSphere Integrated Solutions Console
Resources → Resource Environment → Resource Environment Providers → WP CPConfigurationService → Custom properties

Modify the following custom properties:

- Name: com.ibm.wps.cp.tagging.isTaggingEnabled
  Value: false
- Name: com.ibm.wps.cp.rating.isRatingEnabled
  Value: false

The module can also be removed from the theme profile. The module name is wp_tagging_rating; by default it is in the deferred section of profile_deferred.json. For performance benchmarks, this module was left enabled, but the deferred section of the profile was never loaded as part of the measured workload, so the performance impact of removing it is unknown.

Mashup Multipart Tuning

The Portal 8.5 theme multipart downloading can be disabled to improve performance. Be aware that disabling this may cause performance issues on client side aggregation themes from earlier Portal releases.

How to Set

In the WebSphere Integrated Solutions Console
Resources → Resource Environment → Resource Environment Providers → WP CommonComponentConfigService → Custom properties

Modify the following custom properties:

- Name: cc.multipart.enabled
  Value: false (the default)
- Name: cc.multipart.correlatehosts
  Value: false

Disable Friendly URLs

Friendly URLs enhance the end user's experience by placing a meaningful name in the browser's address field. However, there is a cost for using friendly URLs. In our results, disabling friendly URLs improved capacity by 2% or more depending on the theme.

If you are using Blogs, Wikis or WCM content pages, do not set friendly.enabled or friendly.pathinfo.enabled to false. For further discussion of this see https://help.hcltechsw.com/digital-experience/9.5/wcm/wcm_config_wcmviewer_friendlyexample.html

To fully use friendly URLs, pages must be configured with friendly names.

How to Set

In the WebSphere Integrated Solutions Console
Resources → Resource Environment → Resource Environment Providers → WP ConfigService

Modify the following custom properties:

- Name: friendly.enabled
  Value: false
- Name: friendly.pathinfo.enabled
  Value: false

Setting friendly.enabled to false, turns off Portal's use of friendly URLs. Setting friendly.pathinfo.enabled to false turns off WCM's use of friendly URLs. If WCM is not used in an installation, and friendly names are used by Portal, it is still advantageous to disable friendly.pathinfo.enabled.

Rendering Only Environments

Subscriber Only

For Portal systems where no WCM authoring or page management is taking place locally, syndication overhead can be eliminated by specifying 'subscriber only'. Set deployment.subscriberOnly to true in WCM WCMConfigService. Additional information can be found at https://help.hcltechsw.com/digital-experience/9.5/wcm/wcm_config_prop_syndication.html.

How to Set

In the WebSphere Integrated Solutions Console
Resources → Resource Environment → Resource Environment Providers → WCM WCMConfigService → Custom properties

Name: deployment.subscriberOnly
Value: true

Site Toolbar

For rendering only sites where page management is not taking place locally, the Site Toolbar can be disabled. Set global.toolbar.enabled to false and default.toolbar.enabled to false in WP VirtualPortalConfigService. Additional information can be found at https://help.hcltechsw.com/digital-experience/9.5/wcm/wcm_mngpages_disabletool.html.

How to Set

In the WebSphere Integrated Solutions Console
Resources → Resource Environment → Resource Environment Providers → WP VirtualPortalConfigService

Modify the following custom properties:

- Name: global.toolbar.enabled
  Value: false
- Name: default.toolbar.enabled
  Value: false

Getting Rid of Cache Invalidations

To reduce unnecessary cache invalidations set cache.dynamic.content.spot to false in WP ConfigService.

How to Set

In the WebSphere Integrated Solutions Console
Resources → Resource Environment → Resource Environment Providers → WP ConfigService → Custom properties
Name: cache.dynamic.content.spot
Value: false

This setting increased throughput when using the Portal 8.5 theme, but might have a performance impact with the Page Builder theme. If an installation is using the Page Builder theme as well as the Portal 8.5 theme, benchmarks should be run to determine if the net effect is positive before setting this value.

Cache ra:collections

To allow caching of ra:collection URLs, set resourceaggregation.cache.markup to true in WP ConfigService.

How to Set

In the WebSphere Integrated Solutions Console
Resources → Resource Environment → Resource Environment Providers → WP ConfigService

Name: resourceaggregation.cache.markup
Value: true

Disable Portlet Capability Filter

The runtime portlet capabilities filter allows a Portal developer to get friendly error messages on pages if the theme profile that is in place for a page does not contain all the capabilities that the portlets on the page require. This is very useful for development purposes, but has an undesirable overhead in a production environment. In production this filter should be disabled as the pages should be properly debugged before going into production.

More information about these settings can be found at https://help.hcltechsw.com/digital-experience/8.5/dev-theme/themeopt_mod_capfilter_settings.html

To disable, set resourceaggregation.enableRuntimePortletCapabilitiesFilter to false in WP ConfigService.

How to Set

In the WebSphere Integrated Solutions Console
Resources → Resource Environment → Resource Environment Providers → WP ConfigService → Custom properties

Name: resourceaggregation.enableRuntimePortletCapabilitiesFilter
Value: false

Navigator Service

The navigator service manages the content model for unauthenticated users, which controls the pages those users are able to see. This content model is periodically reloaded by WebSphere Portal. New pages which are visible to unauthenticated users will not be available until the next reload occurs. Our environment assumes a low rate of change for pages, so we set this reload to only occur once per hour. In a production environment where new pages for unauthenticated users are rarely created, setting this reload time to an hour or more will give better performance. In a test or staging environment where updates to unauthenticated pages need to be seen more often, a lower reload time is more appropriate.

This service also controls the HTTP cache-control headers which will be sent on unauthenticated pages. While our environment did not exploit HTTP page caching, increasing these cache lifetimes in a production environment can reduce load on the Portal. For more discussion of the use of HTTP cache-control headers with WebSphere Portal, refer to https://help.hcltechsw.com/digital-experience/9.5/security/tune_cache.html.

How to Set

In the WebSphere Integrated Solutions Console
Resources → Resource Environment → Resource Environment Providers → WP NavigatorService → Custom properties

Table 8 Navigator Service Settings

NavigatorService.properties

Parameter	Default Value	Value Used	Definition
public.expires (seconds)	60	3600	Determines cache expiration time for unauthenticated pages in browser caches and proxy caches. If the setting remote.cache.expiration is also set to a value greater than or equal to 0, the smaller one of the two values is used.
public.reload (seconds)	60	3600	WebSphere Portal maintains an internal cache of the list of pages visible to unauthenticated users, and the arrangement of portlets on those pages. This controls how frequently that internal cache is refreshed. Note, however, that this is not caching the content of those pages – simply their layout.
remote.cache. expiration (seconds)	10800	28800	Determines cache expiration for caches outside of the Portal server for authenticated as well as for unauthenticated pages

Registry Service

HCL Portal maintains information about many resource types in its databases. Some of these resources are replicated into memory for faster access; this is provided by the registry service. This replicated information will be periodically reloaded from the database, thus picking up any changes which may have been made on a peer node in a clustered environment.

The registry service allows configuring a reload time, in seconds, for each type of data which it is managing. In a production environment, we expect this type of information changes very infrequently, so we used very long reload times for the registry service. These values do not include a size parameter as they are a full replication of the database.

How to Set

In the WebSphere Integrated Solutions Console
Resources → Resource Environment → Resource Environment Providers → WP RegistryService → Custom properties

Table 9 Registry Service Settings

RegistryService.properties

Parameter	Default Value	Value Used	Definition
default.interval	1800	28800	Reload frequency for any object types not explicitly specified in the file.
bucket.transformationapplication.interval	600	28800	Reload frequency for transformation application definitions
bucket.transformation.interval	600	28800	Reload frequency for transformation definitions

Cache Manager Service

The cache manager service in HCL Portal is used to cache a wide variety of types of information in memory. These caches are somewhat similar to the registries maintained by the registry service, as each type of information gets its own cache. The key differences are:

- The information stored in the cache manager service's caches tends to be more dynamic than the information stored in the registry service's registries.
- The caches used by the cache manager service are limited in size, and entries will be discarded when the caches become full. The registries used by the registry service are not size-limited; they contain all entries of the specific data type.
- Expiry times are managed individually for each entry in the cache, managed by the cache manager service. In contrast, when the reload time is reached for a registry, the entire contents of that registry are reloaded.

How to Set

In the WebSphere Integrated Solutions Console
Resources → Resource Environment → Resource Environment Providers → WP CacheManagerService → Custom properties

Each cache has several configurable options. A full discussion of these options, along with a list of the caches in HCL Portal 8.5, is given in the Internal Portal Caches section. The table that follows lists the changes which we made to the CacheManager service for performance benchmarks. Size values are specified in "number of objects" and lifetime values are specified in "seconds".

Table 10 CacheManager Service Settings

CacheManagerService.properties			
Parameter	Default Value	Default Value (CF04)	Value Used
cacheinstance.com.ibm.wps.ac.AccessControlUserContextCache.size	4000	6000	6000
cacheinstance.com.ibm.wps.ac.ChildResourcesCache.lifetime	7200	28800	28800
cacheinstance.com.ibm.wps.ac.CommonRolesCache.size	30000	40000	33000
cacheinstance.com.ibm.wps.ac.ExternalOIDCache.lifetime	8640	28800	-1
cacheinstance.com.ibm.wps.ac.OwnedResourcesCache.enabled	True	False	False
cacheinstance.com.ibm.wps.ac.PermissionCollectionCache.lifetime	10240	14400	-1
cacheinstance.com.ibm.wps.ac.ProtectedResourceCache.lifetime	10143	14400	14400
cacheinstance.com.ibm.wps.datastore.services.Identification.SerializedOidString.cache.size	2500	5000	5000
cacheinstance.com.ibm.wps.model.factory.UserSpecificModelCache.size	2000	6000	6000
cacheinstance.com.ibm.wps.pe.portletentity.lifetime	5800	28800	28800
cacheinstance.com.ibm.wps.pe.portletentity.size	10000	5003	5003
cacheinstance.com.ibm.wps.policy.services.PolicyCacheManager.lifetime	7780	43200	43200
cacheinstance.com.ibm.wps.puma.CommonPrincipalCache.size	10000	30000	30000
cacheinstance.com.ibm.wps.puma.DN_OID_Cache.size Higher values can get a better hit ratio but not increase throughput	1500	30000	30000
cacheinstance.com.ibm.wps.puma.OID_DN_Cache.size	1500	5000	5000
cacheinstance.com.ibm.wps.resolver.data.cache.DataSourceCache.size	1000	10000	8000
cacheinstance.com.ibm.wps.resolver.data.cache.FirstLevelDataSourceCache.size	1009	5000	2003
com.ibm.wps.resolver.cor.cache.uri	2000		2000
cacheinstance.com.ibm.wps.resourceaggregator.ContributionsCache.size	20	1000	1000
cacheinstance.com.ibm.wps.services.vpmapping.HostnameToVirtualPortalIDCache.lifetime	3600		-1
cacheinstance.com.ibm.wps.spa.parser.locale.FirstLevelLocalizationParserCache.size	1000	1000	1009

cacheinstance.com.ibm.wps.spa.parser.skin.FirstLevelSkinParserCache.size	1000	1000	1009
cacheinstance.com.ibm.wps.spa.parser.theme.FirstLevelThemeParserCache.size	1000	2000	2003
cacheinstance.com.lotus.cs.services.UserEnvironment.size Tune this if live names support is used	2000	2000	4500
cacheinstance.DigestCache.cache.size	2000	50000	45000

Unused Caches

Even though unused caches use some memory, the amount is minimal so it is not recommended to lower them below their default size.

Cache Sizes

For some cache types, performance will be better if the cache size is a prime number due to a lower probability of cache collisions. For such cache types, the actual size is increased, at runtime, to the next prime number equal or greater the size specified.

People Service

When assigning user and group permissions for WCM resources through the People Picker portlet, the People Service is used. While we did not use this tuning for our own benchmarks, in some cases the selection of users and groups may be slow and can be improved by reducing the default search attributes used by the service. In an example, note that People Picker expects 4 attributes. To improve search performance it's possible to configure the same attribute 4 times since only one is needed.
Attribute: pickerPeopleSearchAttribute
Value: cn,cn,cn,cn

More information about defining Search attributes in HCL DX can be found here:
https://help.hcltechsw.com/digital-experience/9.5/admin-system/search_ptlt_rep.html

Tuning via HCL Portal Administration

Disable Search

Search can be disabled to improve performance if the search feature is not needed.

How to Set

In the HCL Portal Administration Page
Search Administration/Manage Search → Search Collections → Delete all collections.

WP 8.0.0.1 CF09 introduced (from PI05486) the new ConfigEngine Task 'Delete Search Service and Collections'. In Portal 8.5 it is included as well. To run this task:
ConfigEngine.sh action-delete-search-services-and-collections-wp.search.service

See http://www-01.ibm.com/support/docview.wss?uid=swg1PI05486 for more information.

These collections include the JCR collection and the "Default Search Collection".

Note that these search collections do not include the WCM Authoring search indexer. For disabling this search collection, see the **Error! Reference source not found.** section in WCM tuning for information.

Other Portal Tuning

Reducing Redirects

Enabling Base URLs in Themes

Enabling base URLs reduces redirects and URL generation computations. This benefit is seen on the default themes shipped with Portal 6.1.5 through 8.5, as well as themes derived from those.

When enabling base URLs, in many configurations the host.name property needs to be set in WP ConfigService. The host name should be set to the value that an end user knows Portal as. For example if a reverse proxy is used, or virtual portals are used, the host.name in WP ConfigService resource environment provider should be the name of the reverse proxy or virtual portal.

How to Set

1. Create a file named redirectoff.xml with the following contents
```
<?xml version="1.0" encoding="UTF-8"?>
<request build="wpnext_372_01" type="update" version="8.0.0.0"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xsi:noNamespaceSchemaLocation="PortalConfig_8.0.0.xsd">
<portal action="locate">
<theme action="update" uniquename="ibm.portal.85Theme">
<parameter name="com.ibm.portal.theme.hasBaseURL"
type="string"update="set">true</parameter>
</theme>
```

```
</portal>
</request>
```

2. From the command prompt use the XMLAccess tool to import the following xml file.
   Windows: xmlaccess.bat -in redirectOff.xml -user <portal adminID> -password <portal admin password> -url http://<hostname>:10039/wps/config

   Unix: ./xmlaccess.sh -in redirectOff.xml -user <portal adminID> -password <portal admin password> -url http://<hostname>:10039/wps/config

Eliminate Redirect on the Login Form

To avoid redirect on the login form page it is necessary to modify a theme JSP file with a text editor.

If using authentication proxies or single sign on (SSO) solutions, the redirect should be left enabled. This will ensure that the login is redirected to the correct 3rd party URL for user transparent authentication.

How to Set

Modify the content of the JSP file<ServerRoot>/PortalServer/theme/wp.theme.themes/default85/installedApps/DefaultTheme85.ear/DefaultTheme85.war/themes/html/dynamicSpots/commonActions.jsp.

Change the **highlighted** fields in this part of the file from this:

```
<portal-navigation:urlGeneration allowRelativeURL="true" keepNavigationalState="false"
contentNode="wps.content.root" home="protected" >
<a href='<% wpsURL.write(escapeXmlWriter); %>' ><portal-fmt:text key="link.login"
bundle="nls.engine"/></a>
</portal-navigation:urlGeneration>
```

To this:

```
<portal-navigation:urlGeneration allowRelativeURL="true" keepNavigationalState="false"
contentNode="wps.Login" home="public" >
<a href='<% wpsURL.write(escapeXmlWriter); %>' ><portal-fmt:text key="link.login"
bundle="nls.engine"/></a>
</portal-navigation:urlGeneration>
```

If a custom login page is used, make sure the contentNode matches the unique name of your login page. In the previous example it was wps.Login. You can find the unique name of your login page under Portal Administration → Manage Pages. The login page is typically found in 'Content Root' → 'Hidden Pages'.

Personalization (PZN)

Some personalization (PZN) features require processing on every page request. If these are not needed, they can be disabled for better performance. Note that even with the below features disabled, WCM will still process PZN rules since it calls the PZN API directly. If PZN is not being used for WCM content the APIs are not called and there is no additional overhead.

Disable PZN Visibility Rules

If a Portal installation is not using PZN rules on individual pages and portlets, a 25% performance gain can be achieved by disabling the processing of these rules. The toolbar *does* use visibility rules. If the toolbar is enabled, as described in this document, do not apply this tuning.

How to Disable Visibility Rules for Pages & Portlets when no virtual portals used

Run the ConfigEngine command:

```
ConfigEngine.sh action-disable-pzntrans -DPortalAdminPwd=<portal admin password> -
DWaspassword=<websphere admin password>
```

How to Disable Visibility Rules for Pages & Portlets when a virtual portal is created using a context path:

Run the ConfigEngine command:

```
ConfigEngine.sh action-disable-pzntrans -DVirtualPortalContext=<contextpath>
-DPortalAdminPwd=<portal admin password> -DWaspassword=<websphere admin password>
```

How to Disable Visibility Rules for Pages & Portlets when a virtual portal is created using a hostname:

Run the ConfigEngine command:

```
ConfigEngine.sh action-disable-pzntrans -DVirtualPortalHostName=<virtual portal hostname>
-DPortalAdminPwd=<portal admin password> -DWaspassword=<websphere admin password>
```

How to reenable PZN:

Run the ConfigEngine command

```
ConfigEngine.sh action-enable-pzntrans.
```

Disable PZN Referrer Headers

PZN also has the ability to use referrer headers to make decisions. If that feature is not used by an installation, it can be disabled for a performance benefit.

How to Disable Personalization Processing of Referrer Headers

Edit <wp_profile_root>/PortalServer/config/services/PersonalizationService.properties.

Set rulesEngine.preprocessor.enabled=false
Restart the Portal server.

Portal 8.0 & 8.5 Theme Profiles

A new modularized theme design became available with WebSphere Portal version 8.0. This design was continued for the version 8.5 theme. These themes permit easier inclusion or exclusion of components. In general it is best to include components that are used, and exclude components that are not used. A more detailed explanation of this is available https://help.hcltechsw.com/digital-experience/8.5/dev-theme/themeopt_module.html

In our evaluation, we used a theme profile based on profile_deferred.json that ships with Portal 8.5. To allow easier comparison to earlier releases, we removed the following theme modules: wp_toolbar_host, wp_toolbar_actionbar, wp_analytics_aggregator, wp_analytics, wp_analytics_tags, wcm_inplaceEdit, wp_sametime_proxy, getting_started_module, wp_toolbar_host_view, wp_tagging_rating_light, wp_toolbar_host_edit. In addition we added a custom module that allowed top navigation to work.

The theme profile is a WebDAV resource. WebDAV resources are stored in the database, not on the file system. A WebDAV client is needed to add or modify the contents of a theme profile. This documentation in the HCL Digital Experience Help Center https://help.hcltechsw.com/digital-experience/8.5/admin-system/webdav_client.html?query=webdav discusses the settings needed to connect to Portal using a WebDAV client.

The theme profile is specified in JSON format. Changing it requires downloading the file using a WebDAV tool, editing and saving the file back to the Portal database. https://help.hcltechsw.com/digital-experience/9.5/dev-theme/themeopt_add_oobmod.html has instructions on how to change the theme profile.

Note that if removing the last item in a section be sure to remove the comma from the previous item.

Pages with Different Theme Profiles

While it is a good idea to include only the theme profile elements that a page actually uses, there is a performance penalty for using different theme profiles on different pages if many pages include the same base profiles, especially if the base includes larger CSS or Javascript files. This is due to the fact that each profile bundles all modules into a single set of Javascript and CSS files. Each bundle has a separate URL. So, each bundle requires a separate download to the user’s browser.

For example, Dojo is a large theme module in terms of download size. So, if there are two pages that need Dojo but each needs different extensions, there are two options:

1. Two Profiles
   Page 1 Profile with Dojo plus Page 1’s extensions.
   Page 2 Profile with Dojo plus Page 2’s extensions.
2. A single profile including Dojo and the extensions needed for both pages.

Option 1 will require a user to download a large amount of content (Dojo) on both pages. Option 2 will only require a single Dojo download. Since the bundles are cacheable in the browser, Option 2 will perform better for users visiting the second page since there will only be one download.

Out of the Box Portal Themes

Portal 8.5 ships with some useful profiles. profile_lightweight performs even better than the custom profile we used in our test. If that profile contains all the function necessary for your site, we recommend you use profile_lightweight for your site. The profile_deferred theme profile also performs very well, but we found that for rendering sites, where the toolbar function is typically disabled, it still makes sense to remove wp_toolbar_host and wp_toolbar_actionbar from the theme profile. For rendering-only environments, where only 'active content, not drafts' are published, a further response time improvement can be achieved by removing wp_draft_page_ribbon from the theme profiles.

In addition it makes sense to make sure the login portlet uses the same theme profile as the other pages. By default, login uses profile_deferred.

Theme Analyzer Tool

Portal 8.5 includes a Theme Analyzer tool that can be used to analyze theme profiles, modules and dependencies. This tool is useful for determining which modules will be loaded by each profile and can help diagnose performance issues with custom themes. This tool can also show the Cache-Control headers that will be applied for each theme module. This is useful in determining why theme resources (ra:collection URLs) are not being cached by web browsers. See https://help.hcltechsw.com/digital-experience/9.5/dev-theme/themeopt_an_analyzer.html for more information.

Disable JCR Text Search

See the Web Content Management Tuning section in for a discussion of text search in the JCR.

Federated LDAP

Disabling Nested Group Searches

For environments where federated LDAP is used, throughput can be improved by disabling nested group caches. Nested group caches are discussed under "Disabling nested group searches" in this document: http://www-01.ibm.com/support/knowledgecenter/SSEQTP_8.5.5/com.ibm.websphere.wim.doc/disablingnestedgroupsearches.html.

How to Set

Run the following commands in wsadmin:

```
<WASRoot>/bin/wsadmin.sh
wsadmin>$AdminTask configureAdminWIMUserRegistry {-customProperties
{"com.ibm.ws.wim.registry.grouplevel=1"} }
wsadmin>$AdminConfig save
wsadmin>exit
```

Enabling WebSphere and VMM to share group info

In a federated ldap environment, WebSphere and VMM can share cached information about groups. Setting this up is described at https://help.hcltechsw.com/digital-experience/9.5/admin-system/reuse_group_info.html.

How to Set

In the WebSphere Integrated Solutions Console
Resources → Resource Environment → Resource Environment Providers → WP PumaStoreService → Custom properties

Create a new custom property.
Name: store.puma_default.filter.assertionFilter.classname
Value: com.ibm.wps.um.AssertionFilter

If not using UX Screen Flow Manager

If a deployment is not using screen flow manager, it can be removed. We saw about a 2% improvement in throughput with it removed. The process for disabling it is described in the link below.
https://help.hcltechsw.com/digital-experience/8.5/screenflow/cfg_opt.html

Java & WAS Fixes

HCL Portal 8.5 and higher releases ship with some fixes for WebSphere and Java. We did our evaluation with the set of fixes that were included with the product as well as the following APAR that resolved a small regression in WAS 8558 and 8559 if you're using that version. It is planned to be included in WAS 8.5.5.10 and above.

8.5.5.8-WS-WAS-IFPI57228.zip
8.5.5.9-WS-WAS-IFPI57228.zip

Database Tuning

Multiple databases domains are used to hold information in HCL Portal and Web Content Manager 8.5. The databases and related domains supported by Portal are:

1. Release (release domain). This is the primary database domain used by the base Portal scenario.
2. Customization (customization domain). This database receives some light traffic in our scenarios.
3. Community (community domain). This database receives some light traffic in our scenarios.
4. JCR (JCR domain). JCR database is used heavily in WCM (Web Content Management) Scenario. This database receives light traffic in all other scenarios measured in our Benchmark report.
5. Likeminds database, used for Likeminds enabled systems. This database is not used in the scenarios measured for the performance benchmarks.
6. Feedback database, used by the feedback subsystem. This database is not used in the scenarios measured for the performance benchmarks.

For more information on creating databases, seehttps://help.hcltechsw.com/digital-experience/8.5/config/config_dbms.html For more information on database domains, see https://help.hcltechsw.com/digital-experience/9.5/plan/db_domains_shared.html.

For base Portal the Release domain is the primary database being exercised.

DB2 Tuning

HCL Portal uses database servers for core functionality. In our measurement environment, we used a DB2 database server for the Portal application. The LDAP server, IBM Tivoli Directory Server also included a DB2 database as a repository, but that database is configured only indirectly through the LDAP administration utilities.

We recommend using a remote database server for high throughput workloads. For our measurements we used IBM DB2 Enterprise Edition 10.1 as our database server.

We built six separate databases within one database server to house the tables and data needed to support each domain. All databases were placed in a single server instance.

AIX

We configure our DB2 database on AIX using the following setup,

- Set the filesystem which will hold the Portal databases to be an Enhanced Journal File System (JFS2) because a large file system is limited to 64GB.
- Turn on concurrent I/O (CIO) for Enhanced Journal File System as this improves performance. To enable CIO, use the following command to mount the database filesystem:
  ```
  mount -o cio /portaldb
  ```
- Increase AIX maximum number of processes per user to 4096.
  The default 500 processes per user is too low for database server, we increase it to 4096 in our AIX environment. To increase it:
  ```
  chdev -l sys0 -a maxuproc='4096'
  ```

While the Portal databases are configured for high capacity performance, various tuning adjustments may be necessary from time to time. Typically these tuning needs are based on the volume of database traffic and the size of table populations.

Linux, Unix & Windows (LUW)

Two of the database attributes, which DB2 relies upon to perform optimally, are the database catalog statistics and the physical organization of the data in the tables. Catalog statistics should be recomputed periodically during the life of the database, particularly after periods of heavy data modifications (inserts, updates, and deletes) such as a population phase. Due to the heavy contention of computing these statistics, we recommend performing this maintenance during off hours, periods of low demand, or when the Portal is offline. The DB2 runstats command is used to count and record the statistical details about tables, indexes and columns. We have used two techniques in our environment to recompute these statistics.

The form we recommend is:

```
db2 runstats on table tableschema.tablename on all columns with distribution on all columns and sampled detailed indexes all allow write access
```

These options allow the optimizer to determine optimal access plans for complex SQL. A simpler, more convenient technique for recomputing catalog statistics is:

```
db2 reorgchk update statistics on table all
```

Not only does this command count and record some of the same catalog statistics, it also produces a report that can be reviewed to identify table organization issues. However, we have found instances where this produces insufficient information for the optimizer to select an efficient access plan for complex SQL, particularly for queries of the JCR database.

We have determined a technique that has the same convenience of the reorgchk command and provides the detailed statistics preferred by the optimizer.

```
db2 -x -r "runstats.db2" "select rtrim(concat('runstats on table ',concat(rtrim(tabSchema),concat('.',concat(rtrim(tabname),' on all columns with distribution on all columns and sampled detailed indexes all allow write access'))))) from syscat.tables where type='T'"

db2 -v -f "runstats.db2"
```

The first command is used to create a file, runstats.db2, which contains all of the runstats commands for all of the tables. The second command uses the db2 command processor to run these commands. These commands can be run on each Portal database and is recommended to run on the JCR and release database data population after significant content population or changes.

To determine which tables might benefit from reorganization, we use the command:

```
db2 reorgchk current statistics on table all > "reorgchk.txt"
```

For those tables which require reorganization, we use the following command to reorganize the table based upon its primary key:

```
db2 reorg table tableschema.tablename
```

You should also ensure that your database servers have adequate numbers of hard disks. Multiple disks allow for better throughput by the database engine. Throughput may also be improved by separating the database logs onto separate physical devices from the database.

You should ensure that the database parameter MaxAppls is greater than the total number of connections for both the data sources and the session manager for all WebSphere Portal application server instances. If MaxAppls is not large enough, you will see error messages in the Portal logs. Remember that there are multiple data sources for Portal, so this setting needs to be large enough to accommodate the maximum JDBC pools size for all data sources on all cluster nodes.

You should use System Managed Storage (SMS) for temporary table spaces to benefit complex SQL which require temporary tables to compute their result sets. This saves time in buffer writes and improves disk utilization.

The maintenance tasks and practices mentioned here were found to be critical to the performance and correct operation ofHCL DX Portal and Web Content Manager in our lab environment. Additional database maintenance and tuning may be needed in your production environments. For further information on DB2 administration and tuning, refer to the DB2 Information Center.

Oracle Tuning

WebSphere Portal uses database servers for core functionality. In this measurement environment, we used Oracle database server for the Portal application. The LDAP server, IBM Tivoli Directory Server included a DB2 database as a repository.

Planning for Oracle Enterprise Edition

On Oracle, we built a single database and created Oracle users to own the tables and data needed to support each domain.

We recommend that you refer to the Oracle Administrator’s Guide to help you make informed database design decisions. Here are the key settings in our Oracle database.

- For better management and performance of database storage, Oracle-Managed Files are used for database, redo logs, and control files.
- Database block size: 8k
- The following tablespace sizing was required to support a Portal with 100,000 authenticated users, approximately 1,000 pages and 50,000 WCM content items with a load generally consisting of database read operations.
  - SYSAUX: 1908MB
  - SYSTEM: 805MB
  - TEMP: 1MB
  - UNDOTBS: 10MB
  - USERS: 561MB
  - ICMLFQ32: 4711MB
  - ICMLNF32: 1MB
  - ICMSFQ04: 230MB

  - ICMVFQ04: 1MB
- Redo log groups: 500MB each.

AIX

We configure our Oracle database on AIX using the following setup,

- Set the filesystem for Portal databases to Enhanced Journal File System (JFS2).
- Turn on concurrent I/O (CIO) for database filesystem as this improves performance. Do not enable CIO for Oracle product filesystem, ie, /u01, as Oracle could fail to start.
  To enable CIO, use the following command to mount the database fileset.
  ```
  mount -o cio /u02
  ```
- Increase AIX maximum number of processes per user to 4096.
  The default 500 processes per user is too low for database server, we increase it to 4096 in our AIX environment. To increase it,
  ```
  chdev -l sys0 -a maxuproc=’4096’
  ```
- Enable AIX async I/O, and increase MinServer to 5.
  smitty aio → Change/Show Characteristics of Async I/O → MinServers = 5
- We also set in oracle user’s profile as Oracle Installation Guide for AIX recommends
  ```
  AIXTHREAD_SCOPE=S
  ```

Linux

We configured our Oracle database on RHEL6 by doing the folliwng:
Tuned the resources limit settings for our Oracle user by adding the following to the /etc/security/limits.conf configuration file:

```
oracle soft nproc 2047
oracle hard nproc 16384
oracle soft nofile 1024
oracle hard nofile 65536
```

For Linux kernel parameters, we ran the fixup script generated during the install process. The script added the following parameters to our /etc/sysctl.conf configuration file:

```
###############################
# ORACLE PARMS
###############################

kernel.shmall = 2097152
#kernel.shmmax = 2147483648
kernel.shmmni = 4096
kernel.sem = 250 32000 100 128
net.core.rmem_default = 4194304
net.core.rmem_max = 4194304
net.core.wmem_default = 262144
fs.file-max = 6815744
net.core.wmem_max = 1048576
fs.aio-max-nr = 1048576
net.ipv4.ip_local_port_range = 9000 65500
```

Oracle Enterprise Edition Parameter Tuning

Database performance is very important for obtaining good overall performance from WebSphere Portal. Below is a list of tuning applied on our Oracle database server with the alter system command. Additional database tuning maybe needed in your production environments. For further information on Oracle database tuning, refer to Oracle Performance Tuning Guide at http://www.oracle.com/technetwork/indexes/documentation/index.html#database.

Command used: alter system set <parameter> scope=spfile;

Table 11 Oracle Database Tuning

Parameter	Value
Sessions	1148
sga_target	4800M
pga_aggregate_target	1595M
Processes	750
open_cursors	1500
db_files	1024

Oracle Database Maintenance

Optimizer statistics are a collection of data about the database and the objects in the database. These statistics are used by the query optimizer to choose the best execution plan for each SQL statement. Because the objects in a database can be constantly changing, statistics must be regularly updated so that they accurately describe these database objects, particularly after periods of heavy data modifications (inserts, updates, and deletes) such as a population phase. We have used the following commands in our environment to recompute these statistics:

```
execute dbms_stats.gather_database_stats(dbms_stats.auto_sample_size, method_opt=>'FOR ALL
INDEXED COLUMNS SIZE AUTO',cascade=>TRUE);
execute dbms_stats.gather_schema_stats(ownname=> '<JCRUSR>', cascade=> TRUE);
```

where <JCRUSR> is the schema owner of the JCR database objects.

SQL Tuning

SQL Server Database Maintenance

Update the SQL Server statistics for Portal, and JCR databases by opening SQL Server Management Studio, selecting New Query, and running the following query:

```
use <db_name> exec sp_updatestats @resample='resample';
```

Other Database Considerations

Cold Start

On a cold start of Portal, when web pages are first accessed, there are some expensive JCR database calls. The results of those database calls are cached. After Portal is warmed up, there shouldn't be any database calls that take a long time to process. It is a good practice for the Portal administrator to access a few of the common pages after a cold start, before Portal is made available for general access. After warmup, if slow database queries are encountered, the Portal Performance Troubleshooting Guide has a section that can assist with troubleshooting database performance issues. See Appendix B – References & Additional Reading for a link to this document.

First Time a User Logs In

HCL Portal maintains some information about users in its database tables, which grow when a user first logs in. Because we were interested in the steady-state performance of HCL Portal, our performance benchmarks evaluate the system after all users have logged in at least once.

Directory Server Tuning

Our measurements used IBM Tivoli Directory Server version 6.3 (ITDS) as the directory server. ITDS use a DB2 database for storing user information. This database is typically located on the same system as the directory server. If your workload involves creating, updating, or deleting users, then occasional database maintenance may be needed on this database.

On a modern server, it should be feasible to fit the majority of your user population in memory on the LDAP server. The directory servers in our base Portal Scenario measurements were tuned with this goal in mind. Note that in ITDS, both the LDAP server and its underlying DB need to be tuned to support this goal.

The easiest way to configure ITDS is to use the graphical idsxcfg tool located in the sbin directory of your LDAP install location (usually /opt/ibm/ldap/V6.3/sbin on UNIX systems). Under the 'Database tasks' item, select 'Performance tuning'. This will open a wizard interface that sets the necessary values based on user input. The percentage of system memory used by the instance should be set to 90%. The DB2 buffer pool sizes should be left as AUTOMATIC, the default. Other values should be set based on the LDAP user population.

Alternatively, the following values can be set manually in ibmslapd.conf. This file is in the etc directory of the LDAP instance home which is set to /home/dsrdbm01/idsslapd-dsrdbm01 by default on UNIX systems. You must restart the LDAP server after changing these values.

These values are applicable for the base Portal data population of 100,000 users and 15,000 groups. Note that the entry cache size and group member cache size are set to the number of users and groups in LPA so that all users and groups should be cached by the server.

Table 12 IBM Tivoli Directory Server Settings

Parameter	Value
ibm-slapdACLCacheSize	25000
ibm-slapdEntryCacheSize	100000
ibm-slapdFilterCacheSize	1000
ibm-slapdFilterCacheBypassLimit	100
ibm-slapdDbConnections	15
ibm-slapdGroupMembersCacheSize	15000
ibm-slapdGroupMembersCacheBypassLimit	100

Web Server Tuning

IBM HTTP Server (IHS) Tuning

We used the following tunings in the httpd.conf file on our web servers. The HTTP server was configured to cache content.

Process & Thread Settings

Table 13 IBM HTTP Server Settings

Parameter	Linux & AIX	Windows
KeepAliveTimeout	5	5
This value is less than the think time defined in our load measurement scripts to ensure that testing is conservative – forcing virtual users to open new TCP connections for each new page view. In a live environment, it can be helpful to increase the KeepAliveTimeout. However, a higher timeout value can increase contention for HTTP server processes, so if you are running out of HTTP processes, decrease this value.		
ThreadsPerChild	280	2000
The higher number of threads per child on Windows is due to a different process model for IHS on Windows.		
MaxKeepAliveRequests	0	0
Selecting 0 lets an unlimited number of requests calls to a single TCP connection.		
MaxRequestsPerChild	0	0
StartServers	2	N/A
Access logging	off	Off
This was turned off by commenting out the following configuration line: CustomLog /usr/HTTPServer/logs/access_log common.		
ThreadLimit	280	2000
ServerLimit	25	N/A
This value should be set to MaxClients ÷ ThreadsPerChild.		

MinSpareThreads	25	N/A
MaxSpareThreads Should be set to the same values as MaxClients.	7000	N/A
MaxClients	7000	N/A

For Linux and AIX, these values assume that IHS is using the default Worker Multi-Processing Module. This module creates multiple processes (Servers) to handle requests. Each Server, in turn, can create multiple threads. HTTP requests are handled by a thread. So, the number of threads determines how many concurrent connections the server can service. In the above settings, notice that the ThreadLimit setting multiplied by the ServerLimit is equal to the MaxClients value. If MaxClients is set lower, each server will not be able to start as many threads as are set in ThreadLimit.

To increase MaxClients, either the ServerLimit or ThreadLimit or both must also be increased. Benchmark measurements have shown that increasing threads provides better performance than adding servers, up to several hundred threads per server process. So, when increasing settings, raise the number of threads first before raising the number of servers. This reduces the overall memory needed by the HTTP server.

The values used in the performance benchmarks are set to ensure there are sufficient resources to handle hundreds of hits per second from thousands of users. For smaller environments, lower values which use less server resources can be used. For example, to serve several hundred hits per second, ServerLimit could be set to 5, ThreadLimit could be set to 160 and MaxClients could be set to 800.

The value of 0 for MaxRequestsPerChild means that each web server process will serve an unlimited number of requests. In production, it may be beneficial to set this to a larger number so that processes are occasionally restarted to prevent memory leaks. When changing the value, consider the average load since performance could be impacted if processes are restarted too quickly. Ideally, each process should be kept alive for an hour or more. This may require a MaxRequestsPerChild value in the tens of thousands. Also, this is per process, so the maximum requests should be modified based on the values of StartServers and ServerLimit which control the total number of web server processes.

On Windows, only a single process is supported. The number of threads this process can start will be limited by available memory. In performance benchmarks, this limit was around 2,500 threads on 32 bit IHS. Currently, there is no 64 bit version of IHS on Windows. So, if more threads are needed, a separate non-Windows server will be needed for IHS.

Monitoring HTTP Server Activity

We enabled the server-status module so that the number of running and available Web server processes could be monitored under load. This enables appropriate tuning of the above parameters.

IHS as a Caching Proxy

With any theme, large resources can have a significant impact on end user performance. The performance impact of these can be minimized by compressing and/or caching them outside the application server.

There are two choices for caching: using a reverse proxy or enabling caching in the HTTP server. In this section we discuss both options.

We suggest having the HTTP server reside on a different server than Portal for high workloads. Caching on the HTTP server is a good solution in this setup. A reverse proxy should be used only when they can provide local caches to users who are geographically dispersed. Other configurations are viable, but make sure that large cacheable resources are cached and compressed. We saw a significant performance improvement by having Portal compress the content at startup and having the HTTP server cache the already compressed content.

The advantage of using a reverse proxy over an HTTP server for caching depends on the topology used. In general it is best to have the caching done on a system other than the application server. If the HTTP server is on the same server as the application server, it is good to use a separate server as a caching reverse proxy. The disadvantage of using a reverse proxy is the difficulty of configuring it so it compresses content, caches it and does not send a Vary header to Internet Explorer.

We used IBM HTTP Server 8.5 in our measurement environment. The cluster configuration and 64-bit Windows have a remote web server. All other configurations have the web server running on the same system as the WebSphere Portal application server. If, during your monitoring, you notice insufficient processor capacity on the system when running the web server and the Portal server on a single system, consider separating the servers onto different systems.

Regardless of the configuration, to get acceptable throughput and response times under high load for the Portal 8.5 theme, some external caching must be in place. This allows some content to be fetched without going to the Portal server.

Enabling Caching in IHS

For HTTP server caching, there are 2 possibilities: disk caching and in-memory caching. In-memory caching is faster. However in-memory caching is deprecated. In addition, with proper setup of the operating system's file system buffering, disk caching achieves results similar to in-memory caching. In the Portal 8.5 performance evaluation, disk caching was used

The advantage of using in-memory caching is that it may run faster than on-disk caching. The disadvantage is that in-memory caching could use more main memory since each IHS process maintains its own cache. Disk caching implicitly uses system memory as file system cache which can be swapped out if needed. The operating system may be more efficient at managing memory than the in-memory caching algorithms. Benchmarks using both configurations are recommended to determine the best configuration in a specific environment.

These values are set in the HTTP server's httpd.conf file:

How to Set In-Memory Caching

```
LoadModule cache_module modules/mod_cache.so
<IfModule mod_cache.c>
   LoadModule mem_cache_module modules/mod_mem_cache.so
   <IfModule mod_mem_cache.c>
      CacheEnable mem /
      CacheIgnoreHeaders Set-Cookie
      MCacheSize   102400
      MCacheMaxObjectCount 10000
      MCacheMinObjectSize 1
      # Needed with themes before WP 7.0.0.2
      # MCacheMaxStreamingBuffer 6291456
      MCacheMaxObjectSize 6291456
   </IfModule>
</IfModule>
```

Note that the MCacheMaxStreamingBuffer setting was used for Portal themes before version 7.0.0.2. Use this directive the aid the cacheability of larger theme elements that do not have Content-Length headers set. For newer themes, all out of the box theme content has a correct Content-Length header and this directive does not have to be specified. This leaves the value at the default of 100000.

How to Set Disk Caching

These values are set in the HTTP server's httpd.conf file:

```
# disk caching
LoadModule cache_module modules/mod_cache.so
<IfModule mod_cache.c>
 LoadModule disk_cache_module modules/mod_disk_cache.so
 <IfModule mod_disk_cache.c>
  CacheEnable disk /
  CacheRoot /ihscache
  CacheDirLevels 2
  CacheDirLength 1
  CacheIgnoreHeaders Set-Cookie
  CacheMaxFileSize 10000000
  CacheIgnoreNoLastMod On
  CacheDefaultExpire 86400
 </IfModule>
</IfModule>
```

Make sure that the the HTTP server has permission to write to the location specified by CacheRoot by running the command chown nobody /ihscache.

Make sure to select either disk or in memory caching, but not both. If a caching reverse proxy is used, in most cases there is no need for caching on the HTTP server as well.

Performance Considerations

For best performance, it may be necessary to place the disk cache on a separate disk. This not only helps IO throughput, but also allows changing mount options on the cache disk. For best performance, set the noatime option on the filesystem to prevent writing access times on each file read.

More information on configuring disk caching can be found on the HCL Digital Experience Q&A forum : https://hclpnpsupport.hcltech.com/community?id=community_question&sys_id=bb14b57d1be10c9c7776 1fc58d4bcbd1

Adding Cache Headers in IHS

The HTTP protocol allows the server to tell clients how long they can cache responses. When the client has the content in their cache, they do not need to request it again, saving the round-trip time to the server to retrieve the content.

This is done by adding Cache-Control headers to the content which we wish to make cacheable. By default, WebSphere Portal 8.5 will include these headers for static content it served from the theme (ra:collection URLs) and WCM. More information on configuring Portal's default cache control headers under:

Appendix A: Where Cache-control headers are set.

It is possible to use mod_expires and mod_headers in IBM HTTP Server to add the same headers to images, JavaScript and other static content for which Portal does not add headers.

How to Set

Add the following to the httpd.conf file. If you don't add the LoadModule directives, the subsequent directives won't work.

```
LoadModule expires_module modules/mod_expires.so
LoadModule headers_module modules/mod_headers.so

AllowEncodedSlashes On
ExpiresActive On

# Note that the following max-age=86400 is just an example.
# A lower value might be more appropriate for your site
# Make sure that the LoadModule directives above have been issued. Alternatively you can have a check if module is loaded before invoking the following directives. That is not shown here because the intent is that they should be loaded.

<LocationMatch "\.(gif|jpeg|jpg|png|ico|css|js|swf|json)$">
  header setifempty Cache-Control "public,max-age=86400"
  ExpiresDefault "access plus 1 week"
</LocationMatch>
```

```
# if a newer version of dojo delivered in fixpack, this needs to be updated
<LocationMatch "/wps/portal_dojo/v1.9/dojo/resources/.*\.html">
  header setifempty Cache-Control "public,max-age=86400"
  ExpiresDefault "access plus 1 week"
</LocationMatch>

# added so apache server status won't be cached
<LocationMatch "/server-status">
  header setifempty Cache-Control "no-cache,max-age=0"
</LocationMatch>
```

Note that the setifempty keyword was added in Apache 2.4.7. For earlier versions, the set keyword should be used instead. setifemtpy is preferred since it prevents overwriting existing Cache-Control headers that have already been set by Portal. For more information see:

http://httpd.apache.org/docs/current/mod/mod_headers.html

See Web Server Tuning for WAB for an alternative way to specify these same directives that works for base Portal and WAB.

Content Compression on the HTTP Server

Much of the content served by a WebSphere Portal site can be compressed to reduce transmission time and save network bandwidth. Typically, images should not be compressed (as they are usually stored in a compressed format), but other types of content can show a significant size reduction from compression.

IBM HTTP Server supports Deflate compression through the mod_deflate module. When it is enabled, the HTTP server checks the Accept-Encoding header sent by the browser to see if it can accept a compressed version of the content. If so, the HTTP server will compress the content before sending it to the browser.

In one measurement, we observed an average of 65% network traffic reduction and 2/3 page size reduction when deflate compression is enabled. However, the compression operation does not come for free as we also observed approximately a 50% processor utilization increase on the HTTP server when compressing all pages, including private pages. When compressing only theme elements a 10% increase in CPU utilization was observed. When enabling compression, monitor the CPU usage of the HTTP server. If CPU utilization is elevated for extended periods, consider adding more processing power.

In benchmarks, the best performance was seen when Portal gzipped the content once at startup and the HTTP server cached the compressed version of the content (this is done by default for theme resources). However, this environment does not have a significant amount of other static content. In sites with a large number of static files, performance may be improved by compressing that content as well. This can be done dynamically by the HTTP server.

To enable gzip compression in IBM HTTP Server, add the following lines in httpd.conf:

```
# compress everything but images
LoadModule deflate_module modules/mod_deflate.so
# these next 3 are for outputting to a log and go along with a LogFormat that is not mentioned here.
See http://publib.boulder.ibm.com/httpserv/manual70/mod/mod_deflate.html
DeflateFilterNote Input instream
DeflateFilterNote Output outstream
DeflateFilterNote Ratio ratio

# Insert filter
SetOutputFilter DEFLATE

# Netscape 4.x has some problems...
BrowserMatch ^Mozilla/4 gzip-only-text/html
# Netscape 4.06-4.08 have some more problems
BrowserMatch ^Mozilla/4\.0[678] no-gzip
   # avoid gzip bug in IE 6 (from http://www.contentwithstyle.co.uk/blog/147)
BrowserMatch \bMSIE !no-gzip !gzip-only-text/html

# Do not compress images
SetEnvIfNoCase Request_URI \
\.(?:gif|jpe?g|png|exe)$ no-gzip dont-vary
```

When using the HTTP server for compression, it is also advisable to disable compression on the Portal server for all pages and content by setting the WP ConfigService property com.ibm.wps.resolver.servlet.AbstractServlet.enableGZIP to false. Note this is different than the property used for WebSeal testing, which just disables compression of theme elements (ra:collection URLs); see the RA Compression section for more information.

WebSphere HTTP Plugin Tuning

The plugin allows an IBM HTTP Server for WebSphere Application Server to communicate with a WebSphere Application Server.

The following plugin parameters are set:

ConnectTimeout: 60 (default 5)
So the plugin will wait for a successful connection.

Find more description and how-to set it in http://www-01.ibm.com/support/knowledgecenter/SSAW57_8.5.5/com.ibm.websphere.nd.multiplatform.doc/ae/rwsv_plugincfg.html?lang=en.

Reverse Proxy Tuning

An alternative to caching in an HTTP server is to cache in a reverse proxy.

In the Portal 7.0.0.2 theme, we were unable to get the Edge Server 6.0.2 (with fixes) to compress and cache layerLoader.jsp. Therefore, we did not get acceptable results with Edge Server compression. We did get good results having Portal compress the content, the HTTP server adding caching headers and the Edge Server caching the results.

We did not evaluate an Edge Server with Portal 8.5. However, we did find that IBM Edge Server Version 8.0.0 did not reliably cache the ra: collection URLs because they contain a large HTTP response header. Some other caching proxies do not have this limitation. For Portal to perform well, those URLs must be fetched once and then cached.

Another issue with doing compression in the Edge Server version we used is that the Edge Server will send a Vary HTTP response header if the reverse proxy compresses the reply. If Internet Explorer (IE) receives a reply with a Vary header, IE will always check to see if the item has been modified the next time that item is requested. That is not the desired behavior as it causes an unnecessary request to be sent instead of using the version that is in the browser's cache without sending a message to the server. Make sure that compressed replies sent to IE do not contain a Vary header.

The following are the settings and tunings specified in the reverse proxy's ibmproxy.conf file to get the reverse proxy to work with the Portal 7.0.0.2 Page Builder theme. These also work with the Portal 8.5 theme. These settings allow caching of responses but allow Portal to perform the compression of responses.

Table 14 Reverse Proxy Settings

Parameter	Setting Used
Proxy /wps/* http://<portal-server>/wps/* This is only Proxy statement that's needed for the Portal 8.5 theme.	
Proxy /wps_semanticTag* http://<portal-server>/wps_semanticTag*	
Proxy /searchfeed* http://<portal-server>/searchfeed*	
Proxy /portal_dojo/* http://<portal-server>/portal_dojo/*	
Proxy /PageBuilder2/* http://<portal-server>/PageBuilder2/*	
Proxy /mccenabler/* http://<portal-server>/mccenabler/*	
ReversePass http://<proxy-server>/* http://<portal-server>/*	
ReversePass https://<proxy-server>/* https://<portal-server>/*	
ConnThreads	15
CacheQueries Always http://<portal-server>/*	

ServerConnPool	on
MaxSocketPerServer	20
CacheTimeMargin	5 seconds
CacheFileSizeLimit	2 M
flexibleSocks	off
LimitRequestFieldSize	16384

In the above table <portal-server> should be the hostname of the Portal server; <proxy-server> should be the hostname of the proxy server. Note that end users will access Portal via the proxy server hostname, so the base URL for Portal needs to be set correctly as detailed in the Enabling Base URLs in Themes section.

Internet Explorer & Vary Headers

If Internet Explorer (IE) fetches a cacheable page that contains a Vary HTTP response header, it will always check back with the server to see if the page has been modified the next time the browser accesses the page.

If the page is already in the browser cache and no access to the server is required, this is a wasted request that slows down browser response time and adds unneeded load on the Portal Server. WebSphere Portal will never send IE a Vary HTTP header. However, if a reverse proxy is injected into the path, it is important to make sure the proxy is not adding a Vary header. If there is a Vary header, attempt to configure the proxy so it does not send that header.

Operating System Tuning

In any high-load environment, the operating system must be closely monitored to ensure that its performance is acceptable and consistent. The settings mentioned below are not necessarily optimal for all environments. Rather they are mentioned to highlight that OS tuning needs to be managed in the performance environment as part of any bottleneck resolution process, as well as show the changes we made to achieve sufficient Portal throughput.

AIX

Network Tuning

We changed the following network tuning parameters on all the AIX systems in our measurement environment.

Table 15 AIX Network Settings

Parameter	Value
tcp_sendspace	131072
tcp_recvspace	131072
udp_sendspace	65536
udp_recvspace	655360
Somaxconn	10000
tcp_nodelayack	1
rfc1323	1

These parameters can be set using the no command or through smit. In smit, the path to the change these is
Performance & Resource Scheduling→Tuning Kernel & Network Parameters →Tuning Network Option Parameters→ Change/Show Current Parameters.

To make the changes permanent, also select “Save Current Parameters for Next Boot”.

These tuning settings - particularly the tcp_sendspace and tcp_recvspace values - will allocate a significant amount of memory for network buffers. These can cause a performance problem if the system has a limited amount of memory. In that case, it may make sense to reduce these values.

For more discussion on AIX network performance tuning, please refer to, http://www-01.ibm.com/support/knowledgecenter/ssw_aix_71/com.ibm.aix.performance/interface_network_opts.htm and http://www.ibm.com/developerworks/aix/library/au-aixoptimization-netperform3/index.html.

Enable IOCP

On AIX, using I/O completion ports with AIO requests provides the capability for an application to capture the results of various AIO operations on a per-thread basis in a multi-threaded environment. This functionality provides threads with a method of receiving a completion status for only the AIO requests initiated by the thread.

How to Set

You can enable IOCP on AIX by running smitty iocp.

Verify that IOCP is enabled by running lsdev -Cc iocp. The resulting output should include iocp0 Available I/O Completion Ports.

If this message is not output, run the following commands:

1. smitty iocp
   Change/Show Characteristics of I/O Completion Ports
   Change the state from Defined to Available
2. Reboot the server

Kernel Tuning For AIX Power 7

We set the following AIX threading parameters to handle high contention for our Power 7 system. Adding these to the /etc/environment file makes the changes permanent on reboot.

1. AIXTHREAD_MUTEX_DEBUG=OFF
2. AIXTHREAD_COND_DEBUG=OFF
3. AIXTHREAD_RWLOCK_DEBUG=OFF
4. MALLOCMULTIHEAP=considersize,heaps:4
5. SPINLOOPTIME=4000

Hardware Prefetch

The data prefetch engines in Power processor can aid performance for some applications. However, transactional multi-user applications (like Portal) have data access patterns that will usually be unpredictable due to the large number of concurrent threads. As a result, the data that is pre-fetched by default is unlikely to be needed. This wastes system bandwidth and displaces useful data from the caches. We recommend disabling hardware prefetching on Power 7 servers.

How to Set

Disable hardware prefetching by running dscrctl -n -s 1. This will disable the setting until reboot. To make is persistent, run dscrctl -b -s 1.

To re-enable hardware prefetching, run dscrctl -n -s 0.

To see the current status, run dscrctl -q. Output similar to the following will be displayed:

```
Current DSCR settings:
Data Streams Version  = V2.06
number_of_streams     = 12
```

```
platform_default_pd   = 0x4 (DPFD_MEDIUM)
os_default_pd         = 0x0 (DPFD_DEFAULT)
```

The DPFD_DEFAULT indicates that prefetch is *enabled*. When it is disabled, DPFD_NONE is displayed.

Linux

Network Tuning

For Red Hat Linux on Intel, we add the following settings to file /etc/sysctl.conf, then run the command: sysctl -p.

To inspect current TCP parameters, run the command: sysctl -a | grep tcp

Table 16 Linux Network Settings

Parameter	Value
net.ipv4.ip_forward	0
net.ipv4.conf.default.rp_filter	1
net.ipv4.conf.default.accept_source_route	0
net.core.rmem_max	16777216
net.core.wmem_max	16777216
net.ipv4.tcp_rmem	4096 87380 16777216
net.ipv4.tcp_wmem	4096 65536 16777216
net.ipv4.tcp_fin_timeout	30
net.core.netdev_max_backlog	3000
net.core.somaxconn	10000
net.ipv4.tcp_keepalive_intvl	15
net.ipv4.tcp_keepalive_probes	5

We added the following settings to /etc/security/limits.conf:

```
* soft nofile 65535
* hard nofile 65535
```

We also added the following settings to /etc/security/limits.d/90-nproc.conf:

```
* soft nproc 10240
```

The system will need to be rebooted for these changes to take effect.

Windows

Network Tuning

Using the regedit command, the following registry settings were made in the section HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Services\Tcpip\Parameters

Create a new REG_DWORD for each parameter below.

Table 17 Windows Network Settings

Parameter	Value
MaxFreeTcbs	dword:00011940
MaxHashTableSize	dword:0000ffff
MaxUserPort	dword:0000fffe
TcpTimedWaitDelay	dword:0000001e
TcpWindowSize	dword:0000ffff (65535)
GlobalTcpWindowSize	dword:0000ffff (65535)

Note that some of these values are no longer used in Windows 2008. More details are available from Microsoft at http://msdn.microsoft.com/en-us/windows/hardware/gg463394.

Web Content Management Tuning

In general, the same tuning that was used for the base Portal scenario was used for the WCM scenarios. The main differences are in the cache tuning settings: WCM increases demands on the Portal access control (PAC) component which requires a different set of cache tunings. WCM has an internal set of tunable object caches as well.

On top of cache tunings, WCM can require more Web Container threads and JCR data source connections than the base Portal Scenario, especially for heavy authoring workloads. The differences in tuning are mentioned below.

NOTE: These tunings are to be made in addition to the base Portal tunings unless otherwise specified. Apply the base Portal tunings first.

Tuning via the Integrated Solutions Console

JVM Heap Sizes

Table 18 JVM Heap Sizes for WCM

Parameter	WCM Rendering	WCM Authoring
Initial and Maximum heap size (MB)	4096	3584
Nursery size (MB)	1536	1024

How to Set

See the Heap Size tuning section for base Portal.

Web Container Thread Pool Size

Sixty (60) threads were used for both the minimum and maximum value

How to Set

See the Web Container Thread Pool Size tuning section for base Portal.

Data Source Pool Sizes

Table 19 JDBC Data Source Pool Sizes for WCM

	Rendering Value (min/max)	Authoring Value (min/max)
RELEASE	10/100	10/50 (default)
COMMUNITY	10/100	10/50 (default)
JCR	10/150	10/150

See the Connection Pool Size tuning section for base Portal.

Note that the JCR data pool size should be set to 2.5 times the size of the Web Container Thread pool.

WCM Object Cache

Table 20 WCM Object Cache Settings

WCM Object Caches			
Cache Name	Default Value	WCM Rendering Value	WCM Authoring Value
abspath	5000	32000	8000
abspathreverse	5000	32000	8000
processing	2000	10000	10000
session	2000	6000	6000
strategy	2000	32000	8000
summary	2000	4000	2000

How To Set

In the WebSphere Integrated Solutions Console
Resources → Cache instances → Object cache instances

Detailed descriptions of these caches can be found in the WCM Cache Instances section of this document.

Cache Manager Service

How to Set

In the WebSphere Integrated Solutions Console
Resources → Resource Environment → Resource Environment Providers → WP CacheManagerService → Custom properties

Table 21 Cache Manager Service Settings for WCM

CacheManagerService.properties		
Parameter	Default Value	Value Used
cacheinstance.com.ibm.wps.ac.CommonRolesCache.size	40000	50000
cacheinstance.com.ibm.wps.ac.ProtectedResourceCache.size	5000	20000
cacheinstance.com.ibm.wps.cp.models.ModelCache.CategoryModel.lifetime	3600	28800
cacheinstance.com.ibm.wps.cp.models.ModelCache.ResourceModel.lifetime	3600	28800
cacheinstance.com.ibm.wps.cp.models.ModelCache.ResourceModel.size	10000	2000
cacheinstance.com.ibm.wps.cp.models.ModelCache.TagModel.lifetime	3600	28800
cacheinstance.com.ibm.wps.cp.models.ModelCache.TagModel.size	200	2000
cacheinstance.com.ibm.wps.pe.portletentitycounter.size	2000	5000
cacheinstance.com.ibm.wps.resolver.resource.AbstractRequestDispatcherFactory.size	20	100

Access Control Data Management Service

By using the loadRolesParentBased algorithm in our authoring environment, an approximate 70% improvement in capacity was seen in performance benchmarks.

The loadRolesParentBased setting changes the loading algorithm for the ROLE_INST and LNK_USER_ROLE tables in the database. Instead of loading all assigned roles for a specific principal, only the currently requested access control data is loaded and cached. This is beneficial to a dynamic type of workload like authoring where there are many items being created and deleted that require cache updates. Be aware that this setting may increase database load since fewer items will be cached so be sure that your database server has spare capacity before setting.

How to Set

In the WebSphere Integrated Solutions Console
Resources → Resource Environment → Resource Environment Providers → WP AccessControlDataManagementService → Custom properties

Alternatively, the cache settings can be set in the AccessControlDataManagementService.properties file and updated via the ConfigEngine.

Table 22 Access Control Data Management Service Settings for WCM

AccessControlDataManagementService.properties		
Parameter	Default Value	Value Used
accessControlDataManagement.acucIgnoreResourceTypes	n/a	null (value should be the string "null", not blank)
accessControlDataManagement.loadRolesParentBased **Use the loadRolesParentBased setting in WCM authoring environments only. Leave the default false value in rendering environments.**	false	true

WCM Configuration Service

Table 23 WCM Configuration Service Settings

WCM Configuration Service			
Cache Name	Default Value	WCM Rendering Value	WCM Authoring Value
deployment.subscriberOnly	false	true	False
user.cache.enable	false	true	True
resourceserver.browserCacheMaxAge	600	86400	600

subscriberOnly/User cache

Enable the user cache and subscriberOnly setting. The subscriberOnly setting should be enabled only for environments that will be subscribed to and not syndicated from. We recommend this be enabled in a production rendering environment.

How to Set in the Integrated Solutions Console

In the WebSphere Integrated Solutions Console
Resources → Resource Environment → Resource Environment Providers → WCM WCMConfigService → Custom properties

Name: user.cache.enable
Value: true

Name: deployment.subscriberOnly
Value: true

WCM browserCacheMaxAge

Caching WCM resources in a browser or caching proxy.

Static files like images, CSS and Javascript can be stored in WCM and referenced, via a URL, from a Web Content Viewer portlet or the theme. A performance benefit can be obtained by setting the security on these static resources to allow anonymous users to access them so that they can be shared,cacheable amongst several users through a caching proxy and avoid being served directly from WCM on every request.

WCM will attach a cache-control header to these resources to ensure proper caching by browsers and caching proxies. If the security settings of the resource allows anonymous users to access it, WCM will attach a "public,max-age=600,post-check=300,pre-check=600" cache-control header to the response by default. If the security on the WCM resource only allows authenticated users to see it, you will see a "private, max-age=600" instead. If you wish to modify the timeout WCM uses for the cache-control header, update the following property in the WCMConfigService Resource Environment Provider (REP) using the instructions below.

How to Set in the Integrated Solutions Console

In the WebSphere Integrated Solutions Console
Resources → Resource Environment → Resource Environment Providers → WCM WCMConfigService → Custom properties

Name: resourceserver.browserCacheMaxAge

Value: <timeout value in seconds>

Versions

Typically versions are not necessary in rendering environments since there is no active authoring occurring in your rendering environment. There are however other actions that can cause versions to be created unexpectedly. One example would be modifying Managed Pages using xmlaccess. For this reason we recommend turning off versioning by setting it to manual in rendering only environments. The default setting is to always create a version.

How to Set in the Integrated Solutions Console

In the WebSphere Integrated Solutions Console
Resources → Resource Environment → Resource Environment Providers → WCM WCMConfigService → Custom properties

Name: versioningStrategy.Default
Value: manual

Name: versioningStrategy.AuthoringTemplate
Value: manual

Name: versioningStrategy.Component
Value: manual

Name: versioningStrategy.Content
Value: manual

Name: versioningStrategy.PresentationTemplate
Value: manual

Name: versioningStrategy.SiteArea
Value: manual

Name: versioningStrategy.PortalPage
Value: manual

Name: versioningStrategy.Taxonomy
Value: manual

Name: versioningStrategy.Workflow
Value: manual

WCM Advanced Caching

WCM implements a time based internal caching layer called the Advanced Cache that can be used to significantly increase capacity when using WCM rendering portlets. In our own internal testing of our WCM rendering scenario using a timeout of 24 hour (REL 1D), we were able to achieve a 32% increase in capacity with the SITE cache level setting and a 15% increase in capacity with the SECURED cache level setting. Use of WCM Advanced Caching is recommended if your business requirements allow it.

How to Set
Pick your desired Cache Level (see "When to Use Each Caching Level")
Select the related entries from the table below

In the WebSphere Integrated Solutions Console
Resources → Resource Environment → Resource Environment Providers → WCM WCMConfigService → Custom properties

Name: connect.businesslogic.defaultcache
Value: *See defaultcache value in table below for your desired cache level*
Name: connect.moduleconfig.ajpe.contentcache.defaultcontentcache
Value: *See defaultcontentcache value in table below for your desired cache level*
Name: connect.moduleconfig.ajpe.contentcache.contentcacheexpires
Value: *<formatted_time>*

Table 24 Caching Parameters for WCM

Cache Level	defaultcache value	defaultcontentcache value
None	false	None
Basic (default)	true	N/A
Site	false	Site
Session	false	Session
User	false	User
Secured	false	Secured
Personalized	false	Personalized

Note that Basic caching only works with the WCM servlet. Advanced caching is needed for WCM Rendering Portlets.

When to Use Each Caching Level

Content is not personalized / only anonymous users accessing the system: Site
Every user can access the same cached items
Content is personalized

- Content is unique for different groups of users: Secured
  Users that belong to the same groups will access the same cached items
- Content is unique for different personalization profiles: Personalized
  Users that share the same personalization profile will access the same cached items
- Content is unique for every user: User
  Every user gets its own cached items; items are stored in a cache
- Content is unique for every session: Session
  Every user gets its own cached items; items are stored in the session

Cache Expire Time Formats

When setting the cache expire settings, you can specify either a relative time or absolute time:

REL {integer-value}{units}
ABS {date-format-string}

Where {units} is one of:

d|D for days
m|M for months
s|S for seconds
h|H for hours

Valid {date-format-string} values:

Mon, 06 Nov 2000 09:00:00 GMT
Monday, 06-Nov-00 09:00:00 GMT
Mon Nov 6 09:00:00 2000
6 Nov 2000 9:00 AM

Note: The last two formats assume GMT.

Examples:
contentcacheexpires="REL 300S"
contentcacheexpires="ABS Mon, 06 Nov 2000 09:00:00 GMT"

For more information see
https://help.hcltechsw.com/digital-experience/8.5/wcm/wcm_config_delivery_caching_types.html

WCM Secured Advanced Cache group filter

An additional performance benefit for Secured Advanced Caching can be realized by using the Advanced Cache group filtering feature. Since a group membership is used as the cache key for the Advanced Cache with the Secured setting, if there are a large number of groups that are not being used for access control on WCM items it can decrease the hitrate of the cache. A subset of groups that are only being used for WCM access control can be set to only be used for Advanced Cache key calculation by specifying the property below. In our own internal tests, we realized an additional 3% increase in capacity when using Secured Advanced Caching with this setting. By default, a semi-colon is used to separate the groups listed in the filter

How to Set

In the WebSphere Integrated Solutions Console
Resources → Resource Environment → Resource Environment Providers → WCM WCMConfigService → Custom properties
Name: `connect.moduleconfig.ajpe.contentcache.secured.cache.group.subset`
Value: *<groups to be used in filter>*

JCR Text Search

During our measurements, we have disabled text indexing. In a production environment, text indexing is done periodically, adding new content to the text index. However, the indexing interval is not synchronized with our load plateaus. As a result, if we let text indexing run during our performance measurements, it would likely reduce the reliability and repeatability of our measurements.

We do not recommend disabling text indexing in production authoring environments, as doing so would mean that new content will not be added to the text index, and therefore would not appear in search results.

How to Set

In the WebSphere Integrated Solutions Console
Resources → Resource Environment → Resource Environment Providers → JCR ConfigService PortalContent

Name: jcr.textsearch.enabled
Value: false

Public Page Invalidation

By default, on every page modification, Portal checks if the anonymous user has permissions on that page. If so the ContentModel for the anonymous user will be invalidated in addition to the model of the user who executed the modification. This behavior may have a performance impact if there are a large number of public pages. It can be disabled by changing the content.public.page.invalidation property.

In the benchmark environment, there was no improvement in our own internal scenario because public pages are not modified during the scenario.

How to Set

In the WebSphere Integrated Solutions Console
Resources → Resource Environment → Resource Environment Providers → WP ConfigService

Add the following new property:
Name: content.public.page.invalidation
Value: false

Other WCM Tuning

Theme Profile

In a profile_ctc_deferred.json file we evaluated, our test data had more than 3 levels of content in the page hierarchy, and the primaryNav_overlay and secondaryNav_overlay modules were removed from the theme profile. Removing these two modules improved response time and throughput, but the ability to hover over a link and see all its children is not enabled. Without that functionality, it is necessary to click on the link to see the children. It may also be necessary to leave these modules enabled for mobile sites.

See

Portal 8.0 & 8.5 Theme Profiles for instructions on how to modify a theme profile.

Content Scalability

In our own internal rendering tests, we have scaled as high as 1 million total items across 10 libraries with 100,000 items per library in rendering. In Authoring, we have scaled as high as 500,000 items (10 libraries with 50,000 items per library)

When scaling, the primary issue appears to be the total number of children under any one node. We recommend having no more than 25,000 items.

Personalization Service

In a rendering scenario that uses personalization, performance can be improved by setting the following tuning parameters:

Table 25 Personalization Service Setting for WCM Rendering

PersonalizationService.properties		
Parameter	Default Value	Value Used
rulesEngine.cache.timeout	300	900
Rule results updates can take up to the length of this timeout to show up so set it the timeout to an acceptable duration based on your business requirements.		

How to Set

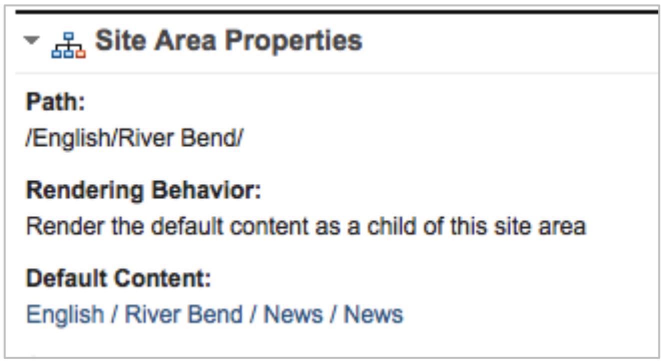
Edit <wp_profile_root>/PortalServer/config/config/services/PersonalizationService.properties.

Set rulesEngine.cache.timeout = 900

Restart the Portal server

Default Content on Site Areas

There can be a performance impact when accessing site areas without default content set. The impact becomes larger as the number of content items under the site area grows. WCM has to parse all of the content items to see which should be the first by title. It is a best practice to set this on every site area even if site areas are not being referenced directly.


Site Area Properties

Path:
/English/River Bend/

Rendering Behavior:
Render the default content as a child of this site area

Default Content:
English / River Bend / News / News

Figure 3 Set Default Content on WCM Site Area

How to Set

In the Web Content Authoring Page
Navigate in the Library Explorer to the site area to be modified
Select the site area and click the Edit button
Click on Select Default Content and choose the content item to be used as the default
Click Ok
Click Save and Close

Size & Structure of Web Content Libraries

In our performance benchmarks, we have tested web content library sizes up to 100,000 content items in rendering and 50,000 content items in authoring with acceptable performance. These items were equally distributed between 10 libraries; every library was of equal size. Larger library sizes were not tested due to the time limitations of setting up and working with such large populations.

Library structure can play an important role in WCM performance. A flat library structure with many children items under one parent can have a negative impact on performance and should be avoided if possible. For the internal benchmarks, content was spread over 500 site areas in a 5-10-10 tree structure with no more than 200 content items under one site area.

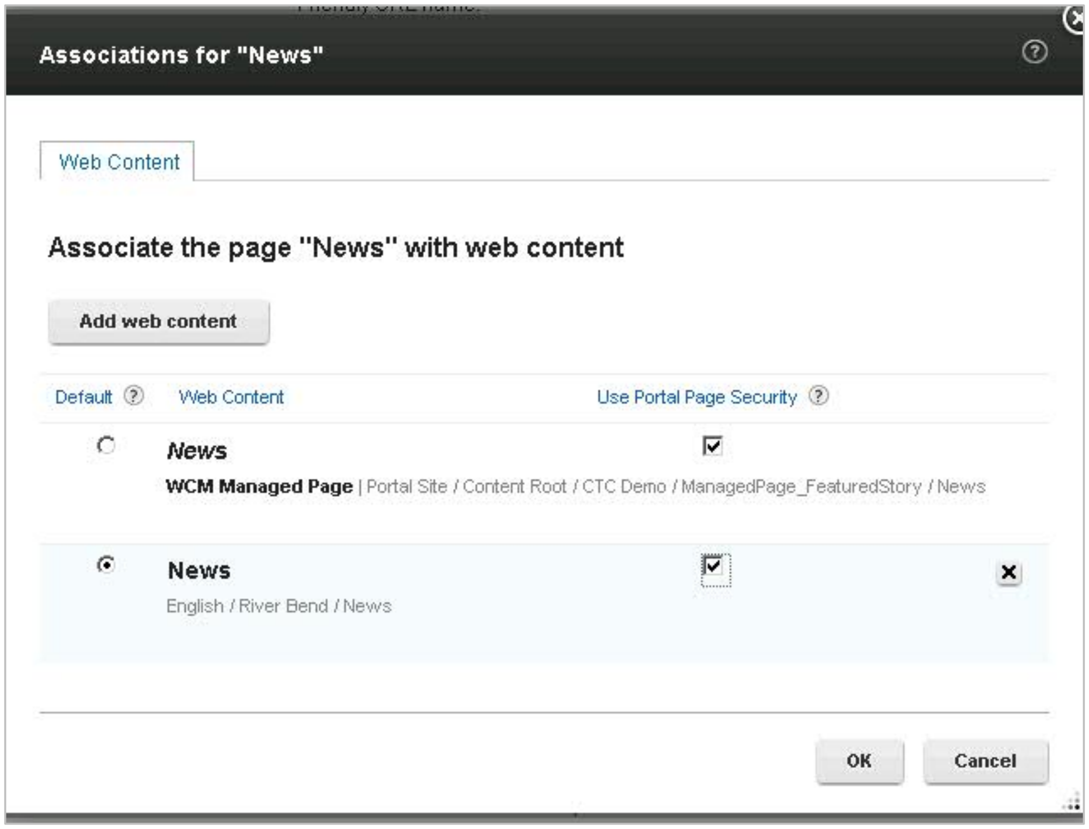
For WCM items such as components, templates, workflows and categories, folders or multiple libraries should be used to minimize the number of children under a parent to avoid a flat library structure. In general libraries should be limited to about 20,000 items total.

Page Level Access Control Delegation

A significant benefit can be achieved by enabling the Use Page Security option with pages that have web content associated with them. This setting bypasses the access control settings on the content items and instead defers to the access control settings of the page. By default this feature is disabled. Benchmarks are run with this setting disabled as well. However, on our WCM rendering scenario we measured a 7.5% increase in capacity when using this feature.

How to Set

In the WebSphere Portal Administration Page
Manage Pages → Content Root → <Page(s) to be modified> → Edit Page Properties
Open Advanced options → I want to edit associations
On the content item enable Use Portal Page Security
Click OK


Associations for "News"

Web Content

Associate the page "News" with web content

Add web content

Default	Web Content	Use Portal Page Security
○	News WCM Managed Page | Portal Site / Content Root / CTC Demo / ManagedPage_FeaturedStory / News	✓
●	News English / River Bend / News	✓

OK Cancel

Figure 4 Set Page Level Access Control Delegation for WCM

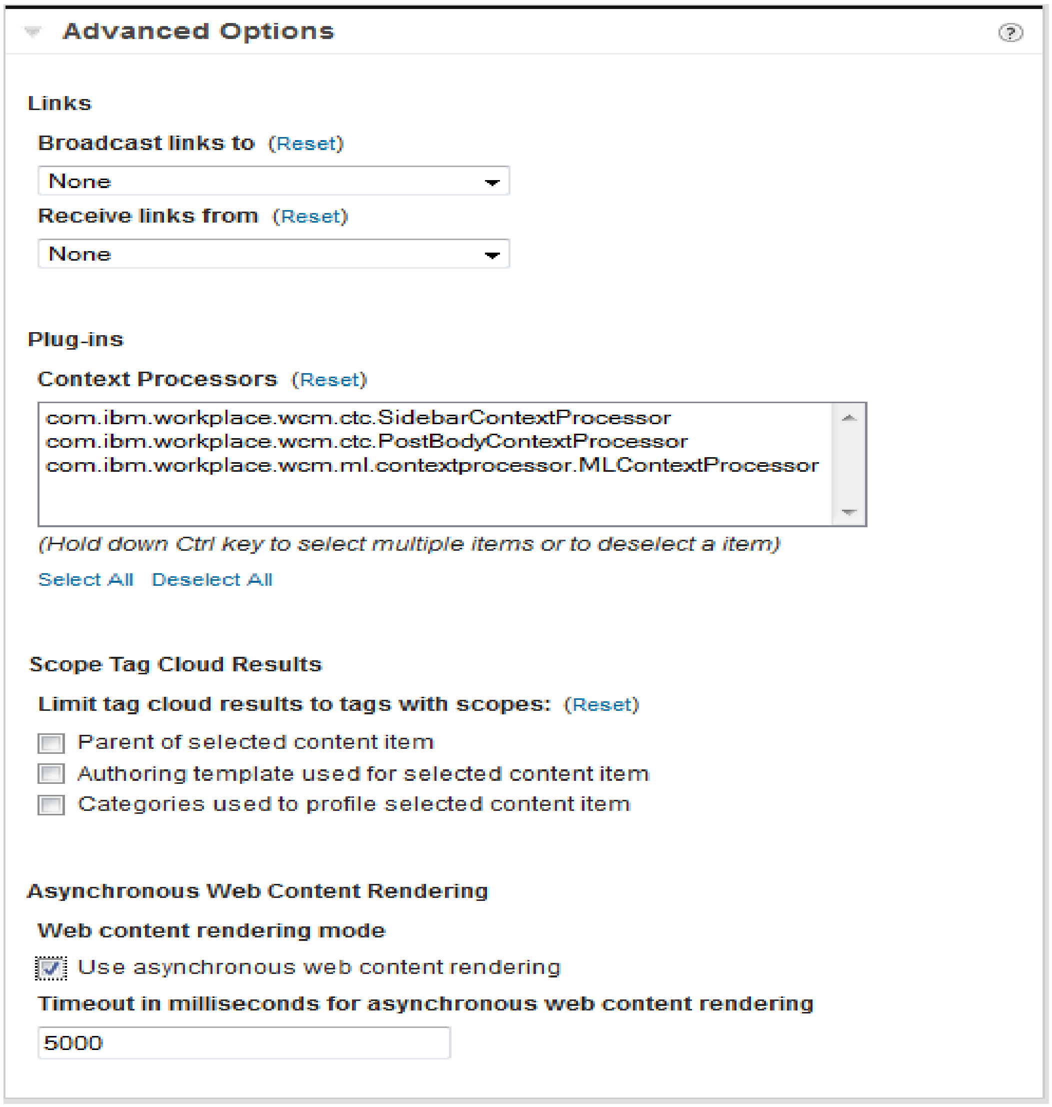
Asynchronous Web Content Rendering

WP 8.5 CF06 introduced the asynchronous web content rendering feature to decrease page loading response times. As described in the HCL Digital Experience Help Center, asynchronous web content rendering can selectively be enabled for Web Content Viewer portlets that take a long time to render. When we apply this feature to heavy-weight Web Content Viewer portlets or Web Content Viewer portlets with a slow back end, we measure significant performance enhancements. But we do not recommend applying this feature to all Web Content Viewer portlets.

How to Set

- Go to the page that contains the Web Content Viewer portlet for which you want to enable asynchronous web content rendering.
- Change to **Edit** mode.
- Open the display menu of the portlet.
- Select **Edit Shared Settings** to enter the configuration mode.

- Expand the Advanced Options section if it is not expanded yet.
- Scroll down to the Asynchronous Web Content Rendering section.
- To enable asynchronous web content rendering for this portlet, select the check box in the Asynchronous Web Content Rendering subsection.
- Click OK to save and leave the Edit Shared Settings mode.


Advanced Options

Links

Broadcast links to (Reset)

None

Receive links from (Reset)

None

Plug-ins

Context Processors (Reset)

com.ibm.workplace.wcm.ctc.SidebarContextProcessor
com.ibm.workplace.wcm.ctc.PostBodyContextProcessor
com.ibm.workplace.wcm.ml.contextprocessor.MLContextProcessor

(Hold down Ctrl key to select multiple items or to deselect a item)

Select All Deselect All

Scope Tag Cloud Results

Limit tag cloud results to tags with scopes: (Reset)

☐ Parent of selected content item
☐ Authoring template used for selected content item
☐ Categories used to profile selected content item

Asynchronous Web Content Rendering

Web content rendering mode

☑ Use asynchronous web content rendering

Timeout in milliseconds for asynchronous web content rendering

5000

Figure 5 Asynchronous Web Content Rendering setting

- There are other values that can be set. For more details, see:

- https://help.hcltechsw.com/digital-experience/9.5/wcm/wcm_config_asynch_wcm_rendr.html

Use of WCM advanced caching with Aynchronous Web Content Rendering is recommended to improve response times of subsequent requests. See the WCM Advanced Caching section for instructions on how to enable WCM advanced caching.

Web Content Viewer Portlet Caching

The Web Content Viewer portlet (JSR 286 version) can be configured to use the Portlet Fragment Cache. Since the fragment cache stores the Content Viewer's generated HTML. This cache can be used in addition to the WCM Object Caches.

This cache was not used in our benchmark testing because the purpose of our evaluation was to focus our analysis on WCM performance. However, you can achieve a significant performance increase by enabling this cache, especially if your Web Content Viewer portlet is displaying non-personalized content.

See the Portlet Fragment Cache section for information on how to enable and monitor the cache.

Projects

WCM and Portal page management authoring environments involves constant database updates. Therefore, the best practice should be to delete unused published projects and update the database statistics on a regular basis (runstats).

How to Delete Published Projects

1. Log into Portal as a WCM Administrator
2. Navigate to the WCM Authoring Portlet
   Applications → Content → Web Content Management
3. In the authoring portlet navigate to
   Project Views → Projects → Published
4. Delete any unused projects
5. Run runstats on the database as specified in the DB2 Tuning section.

WCM Database Tuning

Buffer Pools & DB2 Self Tuning Memory Manager

One of the most important database tuning factors is bufferpool sizing. It is important to evaluate the database's physical versus logical reads and size the bufferpools to achieve a 95% or better hit rate, if possible.

DB2 10.1 supports automatic tuning of bufferpool sizes; we enabled this setting on the JCR database and saw good results. We also gave DB2 an initial bufferpool size for each bufferpool to help the self-tuning memory manager (STMM) reach appropriate sizes more quickly after benchmark rampup. This was done as follows:

```
db2 connect to <jcrdb>
db2 alter bufferpool icmlsfreqbp4 size 1000 automatic
db2 alter bufferpool icmlsvolatilebp4 size 16000 automatic
db2 alter bufferpool icmlsmainbp32 size 16000 automatic
db2 alter bufferpool cmbmain4 size 1000 automatic
db2 -v terminate
```

```
db2 connect reset
```

Where <jcrdb> is the JCR database name. Note that the other Portal database domains used the default settings for DB2.

More information on DB2 STMM can be found in the DB2 10.1 Info Center.

Finally, we recommend that you use DB2 in 64-bit mode to allow sufficient memory for the necessary database objects. This is particularly important with authoring environments as this can be a very database intensive workload. During our testing, database memory became a limiting factor with this workload and we were able to achieve a significant increase in capacity by moving to 64-bit.

Query Optimization

Several DB2 parameters related to how queries are parsed and executed may be beneficial for WCM performance. Improvement from the following sections may be highly dependent on data population. When making changes to these parameters, performance benchmarks should be run on realistic datasets to ensure any changes are actually beneficial.

DFT_QUERYOPT

Prior to CF07, we recommended setting the DB2 database configuration parameter "dft_queryopt" to a value of 2 as this provided the best balance of query optimization time and query execution time for the SQL produced by the JCR.

For CF07 or later, we have changed this recommendation to use the default value of 5 in conjunction with the testing and changes made to the JCR and JCR schema.
This setting is NOT updated automatically within your JCR Database Domain configuration as part of the CF07 (or later) upgrade.

How to Set

This can be done manually by customers by executing the following DB2 command against the JCR domain database:
db2 update db cfg for <JCRDBNAME> using DFT_QUERYOPT 5

OR

It can also be done by running the following Config Engine Task:
<wp_profile_root>/ConfigEngine/ConfigEngine.sh configure-jcr-db2-dft-queryopt

MAX_JOINS_IN_UNION

The DB2 registry variable MAX_JOINS_IN_UNION limits the number of joins that the Query Rewrite component of DB2 is allowed to push down into a UNION operator. Some JCR queries result in a large number of unions with the default settings. Changing this setting limits the number of unions DB2 we use in a query, potentially reducing processing time. This setting should be changed when query preparation times are high on queries with multiple joins.

In general, the more complex the SQL statement and the more complex the database, the more possible ways there are for Query Rewrite to rewrite the query and the more possible query plans there are for DB2 to evaluate. Setting MAX_JOINS_IN_UNION in this case limits the number of possible query plans that DB2 considers, and hence the amount of processing that is done to prepare the query while still generating a good query plan.

Note that setting this value has no effect at query optimization level 1 (see previous section for query optimization).

Performance benchmarks show the best performance with the default setting. No change was observed using a setting of 30. However, data population with deep content hierarchies may benefit from changing this parameter to a higher value.

How to Set

Run db2set DB2_UNION_OPTIMIZATION="MAX_JOINS_IN_UNION=30"

To return to the default setting, run db2set DB2_UNION_OPTIMIZATION=

Collation

By default, collation is disabled for JCR queries. This means that results will not be sorted.
If collation is required, the jcr.query.collation.db2.enabled parameter can be enabled. However, note that there will be a performance impact with this setting due to higher database CPU utilization.

How to Set

In the WebSphere Integrated Solutions Console
Resources → Resource Environment → Resource Environment Providers → JCR ConfigService PortalContent
Name: In the WebSphere Integrated Solutions Console
Resources → Resource Environment → Resource Environment Providers → JCR ConfigService PortalContent

Name: jcr.textsearch.enabled
Value: false
Value: false
Set the property ux to true.
Restart the Portal server.

DB2 Auto Maintenance

For performance benchmarks in our WCM authoring enviornments, automatic maintenance was also turned off using the command db2 update db cfg for <jcrdb> using auto_maint off. Maintenance was disabled to ensure that no database statistics or table reorganizations were performed during the measurement. This setting is not recommended for production. When using automatic maintenance, consider configuring the database to only run during periods of low load.

Oracle

The same Oracle tunings used for base Portal were also used for WCM. See the Oracle Tuning for details.

Web Application Bridge (WAB) Tuning

Web application bridge (WAB) is a feature that allows a user to access a backend server via a portlet. To the end user, it appears that the backend service is part of Portal.

Tuning via the Integrated Solutions Console

The base Portal High Volume Sites tunings were used to acheive optimal WAB performance.

JVM Tuning

MaxDirectMemorySize

In our measurements a 1MB page was accessed via WAB. This required us to set the max direct memory size in the JVM using -XX:MaxDirectMemorySize=1G. Also, to make sure there was enough physical memory for the Portal JVM heap plus the native memory used by direct memory, we increased the physical memory on the system to16GB from 8GB.

If large pages are fetched via Portal (not directly from the back end server) MaxDirectMemorySize can be set to avoid out of memory conditions. See the
MaxDirectMemorySize section in base Portal tuning for more information.

In Portal 8.5, the base Portal scenarios set this value to 1G. The WAB configuration used the same value.

Web Server Tuning for WAB

IBM HTTP Server (IHS) Tuning

The base Portal HTTP server tunings used by base Portal in 8.5 worked well for WAB. No additional changes were required.

WebSphere HTTP Plugin Tuning

WAB requires routing of requests served by the backend server through Portal. This requires modifying the WebSphere HTTP server plugin. By default WAB routes *all* requests to WebSphere (blanket mapping). This is suboptimal because WebSphere does not have to process every request that comes to the HTTP server.

It is better to selectively route requests from the HTTP server to WebSphere. For example, our test fetches this backend page via Portal: http://<yourbackendserver>/wabtest where wabtest is the name of the backend application To make this request get sent to WebSphere we changed this line in plugin-cfg.xml:

```
<Uri AffinityCookie="JSESSIONID" AffinityURLIdentifier="jsessionid" Name="/*"/>
```

to:

```
<Uri AffinityCookie="JSESSIONID" AffinityURLIdentifier="jsessionid" Name="/wabtest/*"/>
```

This change routes any request to /wabtest/anythingElseHere to WebSphere. Note that the /* mapping must be used if more than one backend server is supported by WAB in one environment.

See base Portal tuning section for instructions how to locate the plugin-cfg.xml.

Other WAB Tuning

Selecting users to access the WAB page

Part of setting up a page with the WAB portlet on it involves granting authorization to the portlet. In WebSphere Portal v8001, the option to select 'all authenticated users' was added. If applicable, this option should be selected.

profile_wab Theme Profile

The WAB setup documentation discusses using profile_wab on pages that include the WAB dock portlet. profile_wab contains one theme-profile module that supports WAB: wp_webdock. An alternative to specifying profile_wab on a page that has the Web Dock Portlet, is to add wp_webdock to the theme profile that is used on other pages. This will avoid having to download ra:collection URLs when accessing a WAB page because the ra:collections will already be downloaded and cached by the browser. The downside of this approach is that the ra:collections for other pages will be slightly larger. The increase in size is offset by being able to avoid downloading the ra:collections when accessing the WAB pages.

Refer to the Theme section of this document for more information about theme profiles.

Java Server Faces (JSF)

Apache JSF document http://myfaces.apache.org/docindex.html mentions 3 items that led to a minor improvement:

```
PROJECT_STAGE=production
COMPRESS_STATE_IN_SESSION=false
SERIALIZE_STATE_IN_SESSION=false
```

Those are set in the web.xml for the JSF portlet.

Best Practices

A JSF portlet should follow some best practices. This is not a complete list of best practices. Rather it is a list of practices that allowed our evaluation to get improved throughput.

- If you're displaying large JSF dataTables, they should be paginated. Displaying a thousand rows at once via a JSF dataTable is expensive
- Do not fetch data base records via a bean, which you are not going to use. Populating the beans is expensive. Avoid that overhead by fetching only records your application is going to use.
- Data access beans should not perform a 'context lookup' for every database access like this: javax.naming.InitialContext ctx = new javax.naming.InitialContext(); datasource = (DataSource) ctx.lookup(properties.getProperty("DATASOURCE"));

This is an expensive call. It should be done once and the result should be stored and reused for all later invocations.

- Memory can be freed faster if the managed bean data are stored in the request scope instead of in the user session scope.

Web Experience Factory (WEF)

Tuning via the Integrated Solutions Console

The base Portal High Volume Sites tunings were used to acheive optimal WAB performance.

In addition, the web container threadpool minimum and maximum was set to 60.

Web Server Tuning

IBM HTTP Server (IHS) Tuning

Header Edit Cache-Control ^max-age=0$ “no-cache, no-store”
was added to the httpd.conf file. This stopped the http server from caching elements served by Portal that specified max-age=0 with no other modifiers

Java & WAS Fixes

WEF requires APAR number PI17435 (8.5.0.0-WP-IFPI17435.zip). This fix avoids the refetching of various items when navigating within server side portlets.

Cluster Tuning

In general, the same tuning that is used for the base Portal Scenario should be used in an HCL Portal cluster. The additional settings specific to the clustered environments are mentioned below.

Base Portal Tuning

The cluster tunings start with the tuning mentioned in the Base Portal Tuning section. If a value is specified here as well as in the base Portal tuning section, use the values specified in the cluster tuning section.

The following settings are the same as the base Portal and are listed in the base Portal tunings, but make sure they are set for all cluster members. They are mentioned here as a reminder that they need to be set on all cluster members.

See the VMM Tuning section for how to edit wimconfig.xml. This should be done on the Deployment manager and synchronized to all the nodes. On each cluster member this can be confirmed in /usr/{portal_profile}/config/cells/{cellName}/wim/config.

See the Reducing Redirects section on how to change the base Portal URL and how to edit commonActions.jsp on all cluster members.

See the Shared Class Cache Size section for how to delete the shared class cache on all cluster members.

Tuning via the Integrated Solutions Console

JVM Tuning

The JVM heap size is increased to accommodate the large number of supported users when using memory-to-memory session replication. With in-memory sessions, the initial and maximum heap size are set to 6,144MB (versus 3,584MB with a single node). The nursery size was increased to 2048MB (versus 1024MB with a single node). If not using in-memory sessions, the base Portal JVM settings can be used.

Node Synchronization

In a clustered configuration, changes to WebSphere through the console are made only to the Deployment Manager's local copy of the configuration files. To apply the changes to the cluster, the configuration must be synchronized to each node.

How to Set

In the WebSphere Integrated Solutions Console
Systems Administration → Nodes → <node name> → Full Resynchronize

DynaCache Custom Properties

There are several properties which can be set to reduce the number and size of WebSphere dynamic cache (DynaCache) messages sent between cluster members. This will improve scalability and reduce resource consumption in a clustered Portal environment.

How to Set

In the WebSphere Integrated Solutions Console
Servers → WebSphere_Portal → Java and Process Management → Process Definition → Java Virtual Machine → Custom properties → New

Create the following new properties:

- Name: com.ibm.ws.cache.CacheConfig.ignoreValueInInvalidationEvent
  Value: true
- Name: com.ibm.ws.cache.CacheConfig.filterInactivityInvalidation
  Value: true

For more information on DynaCache, see http://publib.boulder.ibm.com/infocenter/lnxinfo/v3r0m0/index.jsp?topic=%2Fliaag%2Fcache%2Fpubwasdynacachoverview.htm.

Cache Manager Service

To accommodate the increased user volume we made the following changes to the Cache Manager Service settings:

Table 26 Cache Manager Service Settings for 10-node Cluster

CacheManagerService.properties

Cache Name	Default Value	Value Used
cacheinstance.com.ibm.wps.ac.AccessControlUserContextCache.size	6000	10000
cacheinstance.com.ibm.wps.model.factory.UserSpecificModelCache.size	6000	10000
cacheinstance.com.ibm.wps.ac.CommonRolesCache.size	40000	100000
cacheinstance.com.ibm.wps.puma.CommonPrincipalCache.size	10000	100000
cacheinstance.com.ibm.wps.puma.CommonExplicitEntitlementsCache.size	10000	100000

How to Set

See the Cache Manager Service tuning section for base Portal.

VMM Caches

Tune VMM search results and attributes cache to improve the performance of VMM search.

How to Set

1. In the WebSphere Integrated Solutions Console
   Security → Global security
2. Under Available realm definitions ensure Federated Repositories is selected
3. Click the Configure button
4. Click on the LDAP Repository Identifier
5. Click Performance under Additional Properties
6. Change Cache the Attributes cache size to 64000
7. Change Cache the Search Results cache size to 64000
8. Apply

Authentication Cache size

Tune the Authentication cache size to accommodate the increased volume of users.

How to Set

1. In the WebSphere Integrated Solutions Console
   Security → Global security
2. Click Authenticated Cache Settings
3. Click the Configure button
4. Change Cache size to 200000
5. Apply

URL Invocation Cache

Each Java Server Page (JSP) is a unique URL. The URL invocation cache holds information for mapping request URLs to resources. This cache is web container based. The default size is 50.

On cluster runs this setting helped performance. No significant improvement was seen when using this setting in single server benchmarks, however.

How to Set

In the WebSphere Integrated Solutions Console
Servers → WebSphere_Portal → Java and Process
Management → Process Definition → Java Virtual Machine → Custom properties → New

Name: invocationCacheSize
Value: 100

Default Pool

We increased the Default Pool size to handle Distributed Replication Service (DRS) traffic.

How to Set

In the WebSphere Integrated Solutions Console
Click Application servers → WebSphere Portal → Thread Pools → Default Pool
Set the minimum and maximum to 100

Web Container Queue Buffers

How to Set

In the WebSphere Integrated Solutions Console
Servers → Server Types → WebSphere application servers → WebSphere_Portal →Web Container Settings → Web container transport chains

Change the Write buffer size to 65536 for the following queues

- HttpQueueInboundDefault → Web container inbound channel (WCC_5)
- HttpQueueInboundDefaultSecure → Web container inbound channel (WCC_6)
- WCInboundDefault → Web container inbound channel (WCC_2)
- WCInboundDefaultSecure → Web container inbound channel (WCC_4)

Operating System Tuning

AIX Kernel

In addition to the tuning documented for the base Portal AIX kernel, we set the threading parameter, AIXTHREAD_SCOPE=S, to handle high contention for our Power 7 system. This setting can be made permanent across reboots by adding it to the /etc/environment file.

AIX Network

To avoid a socket timeout exception, multiple TCP settings were changed using the chdev command.

How to Set

```
chdev -l en0 -a tcp_sendspace=262144 -a tcp_recvspace=131072 -a rfc1323=0 -a tcp_nodelay=1 -a
mtu_bypass=on
```

Note en0 is the network serving Portal HTTP traffic.

See the AIX Network Tuning section for more information on tcp_nodelay.

Note: tcp_nodelay was set to 0 when using DB Session replication on each of the IHS servers and Portal servers. This provides an increase in replication performance.

Web Server Tuning

In our configuration the 10 Portal servers were supported by 5 IHS web servers. Each server had identical tuning.

WAS Plugin

The following values were used in the WAS plugin:
ServerIOTimeout=180
LoadBalance="Round Robin"

When using LoadBalance="Round Robin" also specify IgnoreAffinityRequests= false (the default is true)

IgnoreAffinityRequests specifies whether the plugin ignores the number of affinity requests made to a server when selecting servers based on the Round Robin algorithm. We have found setting it to false resulted in better load balancing, particularly in a session persistence enabled environment.

Find the full description of these settings in
http://www-01.ibm.com/support/knowledgecenter/SSEQTP_8.5.5/com.ibm.websphere.base.doc/ae/rwsv_plugincfg.html

HTTP Server Tuning

Process & Thread Settings

The following settings were specified in httpd.conf for each of the HTTP servers.

Table 27 HTTP Server Cluster Settings

Parameter	Value
KeepAliveTimeout	5
ThreadsPerChild	150
MaxKeepAliveRequests	0
MaxRequestsPerChild	0
StartServers	2
Access logging	Off
ThreadLimit	150
ServerLimit	200
MinSpareThreads	200
MaxSpareThreads	30000
MaxClients	30000

Note that these settings assume the worker multiprocess model used on Unix systems. On Windows, different values will be needed since only the single process model is supported.

Other HTTP server settings were the same as for the single-server, base Portal environment.

IHS as a Caching Proxy

In the cluster, disk caching was used in the HTTP server. See the IHS as a Caching Proxy section for instructions on how to set up disk caching.

Tuning Session Persistence – Memory-to-Memory

We configure memory-to-memory session replication to use the default “BOTH” (Client and Server) mode in our environment. This means that sessions are sent from the Portal cluster members to other cluster members. Separate application servers are not defined to store the session data.

This mode of session persistence will cause each cluster member to hold more session data than if no replication is used. Therefore we recommend using 64-bit environments for this type of session replication, as well as regular monitoring of heap usage.

In addition to the settings discussed in the previous section for cluster tuning, additional recommendations are made below.

Tuning via the Integrated Solutions Console

The values set via the Integrated Solutions Console can be set on the DM node and then propagated via a full resync. Alternatively, if the primary node is setup with these values, they will be sent to each node when the node is federated into the cluster.

Session Configuration

Session Storage

The default of sessions kept in memory is 1000. For loaded systems, this number should be large enough to cover the expected working set of active sessions. Use PMI to monitor your session count and adjust accordingly.

How to Set

In the WebSphere Integrated Solutions Console
Servers → Server Types → WebSphere application servers → WebSphere_Portal → Container Settings → Session management

Set Maximum in-memory session count to the desired value. For performance benchmarks, 40000 sessions were kept in memory.

Write Frequency

The frequency at which sessions are replicated to other cluster nodes can be customized. For performance benchmarks, the default of every 10 seconds was used. When setting this for production scenarios, consider the tradeoff between losing data and performance. Higher write frequencies may cause worse performance but will ensure less session data is lost when a node fails.

How to Set

In the WebSphere Integrated Solutions Console
Servers → Server Types → WebSphere application servers → WebSphere_Portal → Container Settings: Session Management → Distributed environment settings → Custom tuning parameters

Change the Write frequency to the desired value.

Write Contents

The session data that is replicated can be configured to either write the entire session on each update or just the content that has changed. For performance benchmarks, the default Only updated attributes value was used.

How to Set

In the WebSphere Integrated Solutions Console
Servers → Server Types → WebSphere application servers → WebSphere_Portal → Container Settings: Session Management → Distributed environment settings → Custom tuning parameters

Change Write contents to the desired value.

Session Cleanup

Sessions can also be cleaned up (deleted) on a fixed schedule. For performance benchmarks, the default, which is to not cleanup sessions was used.

How to Set

In the WebSphere Integrated Solutions Console
Servers → Server Types → WebSphere application servers → WebSphere_Portal → Container Settings: Session Management → Distributed environment settings → Custom tuning parameters

Enable Schedule session cleanup and set the time of day to the desired value.

WAS Plugin Configuration

Memory-to-memory replication uses partition IDs rather than clone IDs. This can lead to broken session affinity if changes are not made in the plugin. To avoid this, the GetDWLMTable setting in the plugin config file must be changed to true. See http://www-01.ibm.com/support/docview.wss?uid=swg21318463 for more information

How to Set

Edit plugin-cfg.xml file on the IHS server.
In the <ServerCluster> element set the value of the GetDWLMTable to true.

Tuning Persistence – Database

To enable Session Persistence to Database, a data source with non-XA JDBC driver must be created. We also configured the DB2 Session Database with 32K page size to optimize performance for writing large amounts of data to the database. For details on configuring tablespaces and page sizes for the session database, see the WebSphere Application Server Info Center.

Tuning via the Integrated Solutions Console

Session Configuration

Session Storage

The default of sessions kept in memory is 1,000. For loaded systems, this number should be large enough to cover the expected working set of active sessions. Use PMI to monitor your session count and adjust accordingly.

How to Set

In the WebSphere Integrated Solutions Console
Servers → Server Types → WebSphere application servers → WebSphere_Portal → Container Settings → Session management

Set Maximum in-memory session count to the desired value. For performance benchmarks, 40000 sessions were kept in memory.

Write Frequency

The frequency at which sessions are replicated to other cluster nodes can be customized. For performance benchmarks, Very high was used.

How to Set

In the WebSphere Integrated Solutions Console
Servers → Server Types → WebSphere application servers → WebSphere_Portal → Container Settings: Session Management → Distributed environment settings → Tuning parameters

Change the Write frequency to the desired value.

Session Database

How to Set

In the WebSphere Integrated Solutions Console
Servers → Server Types → WebSphere application servers → WebSphere_Portal → Container Settings: Session Management → Distributed environment settings → Database settings

- Set the Datasource JNDI name to the correct name for the session datasource (ex jdbc/sessions).
- Set the User ID and Password to the correct values for the session database.
- Set the DB2 row size to ROW_SIZE_32KB and ensure the Table space name is set to the correct value. The DB2 tablespace should be configured to support the row size specified.
- Uncheck (disable) Use multi row schema.

Data Source Configuration

Ensure that the data source configured for the session database has a large enough maximum pool size to support the required load. For performance benchmarks a maximum size of 35 was used.

Also ensure that the prepared statement cache size is configured for the data source. For performance benchmarks a size of 15 was used.

See the
Data Source Tuning section for information on how to set these values.

Operating System Tuning

AIX Kernel

In addition to the tuning documented for the base Portal AIX kernel, we set the following AIX parameter to increase max number of processes allowed per user to handle 10 cluster nodes' database connections to the session database server. The default of 128 is too low.

```
chdev -l sys0 -a maxuproc='1024'
```

To display the current setting:

```
lsattr -El sys0 | grep max
```

AIX Enable MTU_Bypass

In addition to the tuning documented for the base Portal AIX kernel, we set the following AIX parameter to enable the Jumbo frames feature (mtu_bypass).

To change the value:

```
chdev -l en1 -a mtu_bypass=on
```

Database Concurrent IO

Our session database is created on a JFS2 file system, to improve throughput, we mount the database using concurrent I/O option.

```
mount -c cio /sessiondb
```

Session Database Tuning

We use IBM DB2 database server for persisting the sessions. We applied the following tunings to our dedicated session database server,

```
db2set DB2_USE_ALTERNATE_PAGE_CLEANING=ON
db2set DB2_RR_TO_RS=YES
db2set DB2_PARALLEL_IO=*

db2 “update db cfg for <sess80> using locklist 5120”
db2 “update db cfg for <sess80> using maxlocks 80”
db2 “update db cfg for <sess80> using dbheap 4800”
db2 “update db cfg for <sess80> using num_iocleaners 8”
db2 “update db cfg for <sess80> using num_ioservers 8”
db2 “update db cfg for <sess80> using logbufsz 256”
db2 “update db cfg for <sess80> using logfilsiz 12288”
db2 “update db cfg for <sess80> using logprimary 40”
db2 “update db cfg for <sess80> using logsecond 30”
db2 “update db cfg for <sess80> using avg_appls 5”
db2 “update db cfg for <sess80> using applheapsz 4096”
db2 “update db cfg for <sess80> using app_ctl_heap_sz 1024”
db2 “update db cfg for <sess80> using stmtheap 32768”
```

Vertical Cluster Tuning

Vertical clusters behave like horizontal clusters and can use either memory-to-memory or database session persistence. See the previous sections on how to tune session persistence in a vertical cluster.

Tuning via the Integrated Solutions Console

DynaCache

In addition to the WebSphere properties mentioned in the previous sections, the dynamic cache service (DynaCache) should also be tuned when vertically clustering more than one node in a single physical system.

First, the cache size needs to be increased. Then, several custom properties need to be set.

How to Set Cache Size

In the WebSphere Integrated Solutions Console

Servers → Server Types → WebSphere application servers → WebSphere_Portal → Container Services → Dynamic cache service

Set Cache size to 3500.

How to Set Properties

In the WebSphere Integrated Solutions Console
Servers → Server Types → WebSphere application servers → WebSphere_Portal → Container Services → Dynamic cache service → Custom properties → New

Create the following new properties:

- Name: com.ibm.ws.cache.CacheConfig.cacheEntryWindow
  Value: 10
- Name: com.ibm.ws.cache.CacheConfig.cacheInvalidateEntryWindow
  Value: 10

High Volume Sites

The tuning documented in the base Portal chapter can allow a single Portal server handle several thousand logged in users serving a few hundred page views per second, depending on application processing requirements. For sites that require more logged in users or where a single, powerful server can handle more than 500 page views per second, it may be necessary to increase some tuning parameters to higher values. These values are detailed in this section.

JVM Tuning

Increase the maximum heap size and the nursery size. See the Heap Size and Nursery Size sections in the base Portal tuning for instructions on how to set these values.

Table 28 JVM Heap Sizes for High Volume Sites

Minimum Heap Size (-Xms)	Maximum Heap Size (-Xmx)	Nursery Size (-Xmn)
5632	5632	2048

VMM Caches

See the VMM Caches section in the base Portal tuning for instructions on how to set these values.

Table 29 VMM Attribute Cache Settings for High Volume Sites

Attribute Cache Property	Default Value	Value Used
Cache size	4000	15009
Cache time out	1200	18000
For the performance benchmarks a timeout of 18,000 was used to avoid having caches timeout when thousands of users were simulated. In an actual customer deployment lower timeout values might work just as well, depending on the login rate and total number of logged in users.		

Table 30 VMM Search Results Cache Settings for High Volume Sites

Search Results Cache Property	Default Value	Value Used
Cache size	2000	15009
Cache time out	600	4800

WebSphere Authentication Cache

Increasing the size of WebSphere's internal LDAP authentication cache removed LDAP CPU utilization spikes seen during a performance run. Without this setting, the CPU spike on the LDAP server causes a throughput drop in Portal after running at high load for long periods of time.

How to Set

In the WebSphere Integrated Solutions Console
Security → Global Security

1. Click Authentication cache settings
2. Change the Maximum cache size to 50000 entries
3. Click OK
4. Save Changes
5. Restart the server

Cache Manager Service

The following cache sizes were changed from the base Portal settings. See the Cache Manager Service section there for the sizes used for other caches as well as instructions on how to set these cache sizes.

Table 31 CacheManager Service Settings for High Volume Sites

CacheManagerService.properties

Parameter	Default Value	Value Used
cacheinstance.com.ibm.wps.ac.AccessControlUserContextCache.size	6000	8403
cacheinstance.com.ibm.wps.model.factory.UserSpecificModelCache.size	6000	8403

HTTP Server Tuning

In order for Portal to handle a high number of requests, the HTTP server must also be tuned to accept at least as many connections as Portal. The settings documented in the Cluster Tuning chapter, under HTTP Server Tuning are a good starting point since the cluster benchmarks also ran a high number of users.

One particular setting that may also be useful for high volume sites is the StartServers and MinSpareThreads parameters. These control how many threads and processes are left running when the server is idle. Setting these to higher values may help performance when there are large spikes in the number of users. Increasing these settings means that there will be more threads already running and available when a large number of users accesses the site at the same time; users will not wait for the server to start more processes (up to MaxClients).

Other Tuning Considerations

In addition to the scenarios discussed above, HCL Portal has some other tuning options which may be useful in some scenarios or when using specific features. These are documented here. Note that unless explicitly overriding a base Portal tuning setting, the tuning previously documented in this chapter still applies and will be required for optimal performance.

Nested Group Cache

In previous versions of this guide, we recommended disabling the nested group cache (com.ibm.wps.ac.groupmanagement.NestedGroupCache). It's important to understand how this cache is used so that it can be set appropriately for your environment.

In some environments – including the lab environment for our performance measurements – nested groups are not used for access permissions. In such cases, two settings can be used to improve performance: disable nested group support, and disable the nested group cache. This is done with the following two settings:

How to Set

In the WebSphere Integrated Solutions Console
Resources → Resource Environment → Resource Environment Providers → WP CacheManagerService → Custom properties → New

Name: cacheinstance.com.ibm.wps.ac.groupmanagement.NestedGroupCache.enabled
Value: false

In the WebSphere Integrated Solutions Console
Resources → Resource Environment → Resource Environment Providers → WP AccessControlDataManagementService → Custom properties → New

Name: accessControlDataManagement.enableNestedGroups
Value: false

If permissions are assigned to nested groups, it is not appropriate to disable nested group support, so the settings above should not be used. In particular, disabling the nested group cache while nested group support is enabled can cause significant performance problem, especially in environments that use third-party authentication software like IBM Tivoli Access Manager (TAM) and WebSEAL.

PAC Warmup Service

In environments with either many pages or with a large amount of WCM content (especially with many explicit role mappings) there can be a large amount of Portal Access Control (PAC) data required to display pages to the user. When first started, Portal will not have any of this data cached and will have to retrieve it from the database instead. As a result, the first several users who o hit the system may see longer response times.

To improve initial response times, the PAC Warmup Service can be enabled to load data into caches at Portal startup. The service will load the specified users or groups asynchronously from the database before users access the site.

Note that syndication or authoring will potentially clear the caches so the warmup is typically useful only for the first hits on the system, before any changes are made to the content.

How to Set

In the WebSphere Integrated Solutions Console
Resources → Resource Environment → Resource Environment Providers → WP AccessControlWarmUpService

Add the following properties:

Name: enabled
Value: true
Name: numberOfMostRecentUsers
Value: 10
Name: numberOfGroups
Value:1
Name: group.1
Value: all authenticated portal users
Name: numberOfUsers
Value: 1
Name: user.1
Value: anonymous portal user
Name: fillResourceCachesDomains
Value: rel,jcr
Name: fillResourceCaches
Value: 0

Note that multiple users and groups can be added by incrementing the user or group number (e.x. group.2) and the numberOfUsers or numberOfGroups property. Ideally all groups or user that have many roles should be loaded.

See https://help.hcltechsw.com/digital-experience/8.5/install/wp_pac_tool.html?query=PAC for more information on this service.

Warming Up Portal Before Opening for Business

The first time Portal is accessed JSPs get compiled. That can be a slow process. Therefore, after starting Portal, but before 'going live' it is a good idea to access a few pages to get common JSPs compiled.

Recording Last Login Time for UsersBy default, WebSphere Portal will record the time a user logs in. This is used for reporting the number of users who have logged in recently; it is also needed for session resumption support. If neither of these features is needed, then it is possible to disable recording the user's last login time.

Disabling the last login time will eliminate an insert or update operation on the USER_DESC table for each user login. This will reduce IO on the database server, but will probably not significantly reduce CPU utilization.

More information about user session persistence is given https://help.hcltechsw.com/digital-experience/8.5/admin-system/adcfgpss.html?query=session%20persistence

How to Set

In the Integrated Solutions Console
Resources → Resource Environment → Resource Environment Providers → WP ConfigService → Custom Properties → New

Add the following properties:

Name: timeout.resume.session
Value: true
Name: persistent.session.level
Value: 0
Name: record.lastlogin
Value: false

Optimizing Retrieval of Permissions in Access Control

In HCL Portal, permissions are granted by assigning a principal to a specific role. There are four types of principals:

Users
Groups
Virtual users (the anonymous "user")
Virtual groups (all authenticated users).

When determining a user's permissions, HCL Portal will check for permission assignments in its access control database for all of these types of principals. However, in some Portal sites, one or more of these classes of principals has no roles assigned. For example, if groups are not used for access control, then there would presumably be no roles assigned to groups.

In this case, a performance optimization is possible. By telling HCL Portal that no roles are assigned to certain types of principals, these queries will never be run. This can save processing time on the Portal server and the database server.

Since roles are always on resources within a specific domain, this performance optimization is specified at the level of a resource domain. Thus the configuration will tell HCLPortal that "No role assignments exist for this type of principal in this domain". For example, "No role assignments exist for Groups in the Community domain".

To enable this performance optimization, first determine which types of principals won't have role assignments and in which domains. Then, for each principal type + domain pair which will not have role assignments, add an entry to AccessControlDataManagementService.properties. The format is:
accessControlDataManagement.domain.domain-name.disableRolesFor.principal-type=true

Replace domain-name with the desired resource domain and principal-type with the desired type of principal. For example, to indicate that no role assignments exist for Groups in the Community domain, the setting would be accessControlDataManagement.domain.comm.disableRolesFor.groups=true.

The principal types are specified as follows:

Users: users
Groups: groups
Virtual users: v_users
Virtual groups: v_groups

The domain name can be any of the valid domains (i.e. rel, jcr, comm, or cust).

If requirements change and role assignments which have been disabled are again needed, this setting can be undone by setting the value to 'false'. For example, to make use of role assignments for Groups in the Community domain, the setting would be changed to:
accessControlDataManagement.domain.community.disableRolesFor.groups=true.

See http://www-01.ibm.com/support/docview.wss?uid=swg1PK85714 for more information.

High Performance Extensible Logging (HPEL)

WebSphere 8 introduced a binary logging format known as HPEL. In some configurations, enabling HPEL may improve performance. However, benchmark tests have also shown a 2% throughput reduction in other configurations. Performance testing in your own environments is recommended to understand the impact of enabling this feature.

How to Set

In the Integrated Solutions Console
Troubleshooting → Logs and trace

1. Select the server(s) that you want to switch to HPEL
2. Save the changes
3. Restart the application server

See http://www-01.ibm.com/support/knowledgecenter/SSEQTP_8.0.0/com.ibm.websphere.base.doc/info/aes/ae/ttrb_compToHPEL.html and http://www.ibm.com/developerworks/websphere/techjournal/1208_bourne/1208_bourne.html for more information.

Improving Portal Startup Performance

HCL Portal 8.5 has two options for reducing the time required to start the application server. These two options are:

Development mode: development mode is intended for software development and testing environments. It is not intended for use in high-load or production environments, as runtime performance may be negatively impacted in such environments.
Portal light mode: light mode is usable in production or test environments. Startup performance is improved. In addition, most deployments will see some reduction in memory consumption.

HCL Portal Developer Mode

WebSphere Portal 6 introduced a “development mode” that greatly improves startup performance. This can be very useful for development environments where the Portal must be stopped and started frequently.

However, it’s important to note that this mode is only meant to be used for development or test environments, not production or performance benchmark environments. Development mode turns on lazy-start for almost all applications in HCL Portal. This can cause a performance impact the first time an application is accessed under load. Development mode also changes the way the JVM is started to give better startup speed at the cost of reducing capacity under load.

To switch to development mode, run the enable-develop-mode-startup-performance configuration task to complete the configuration and optimize the Portal startup. The changes can be reverted to the original values using the disable-develop-mode-startup-performance configuration task.

For more information, see the Developing section of the HCL Digital Experience Help Center:
https://help.hcltechsw.com/digital-experience/8.5/dev/developing_parent.html

HCL Portal Light Mode

WebSphere Portal 8.0 and above provides a new Portal light mode which can improve Portal startup time and reduce memory consumption in production environments.
For more information, please visit the following HCL DX Help Center Administering topic URL:
https://help.hcltechsw.com/digital-experience/8.5/admin-system/portal_light_nbl.html

Managing the Retrieval of User Attributes

A user directory doesn't just contain a user's ID and password; it also contains a number of other pieces of information - attributes - about the user. A directory server can contain a lot of attributes for each user, so if every reference to a user required retrieving all of these attributes, this would impose a performance penalty on both the Portal server node(s) and the directory server node(s).

Therefore HCL Portal attempts to optimize the loading of these attributes. Two sets of user attributes are defined: the base set of attributes, and the minimum set of attributes. Depending on what action caused the user to be retrieved from the directory, either the base or the minimum set of attributes will be retrieved. Typically, the base set of attributes will be loaded when the user is retrieved; for example, this is what occurs when a user logs in. If the user was looked up when searching for users, then the minimum set of attributes will be loaded. For example, this can occur when searching for users to assign access to a page.

By default, HCL Portal defines the user attribute sets as follows:

- Base set: the following attributes are in the base set:
  - uid
  - cn
  - sn
  - preferredLanguage
  - ibm-primaryEmail
  - givenName
  - displayName
- Minimum set:
  - uid
  - cn

What happens if additional attributes are needed? For example, consider a portlet which requires the user attribute countryName. Assume that the user in question was looked up on login, so the base set of attributes was retrieved. The attribute countryName isn't in the base set, so the full user record - with all of its attributes - will be retrieved from the directory server at that point. This will require a second request to the directory server. Also, since all user attributes are retrieved on the second request, this can end up consuming more memory on the HCL Portal server.

This provides an important performance tuning point to both improve response times and reduce load on the directory server. If a user attribute will commonly be needed, then it should be included in the base set of attributes so that it’s retrieved on the initial lookup, eliminating the need for a second request. However, if an attribute is only needed infrequently, consider leaving it out of the base set of attributes, so that it’s not retrieved for all users.

Identifying a Full Fetch of User Attributes

How can you identify a second request is made to the directory server to retrieve the full set of user attributes? This is best done in a test or staging environment, rather than a live production environment, as it requires turning on tracing in the portal server, and this can impose a significant performance overhead. There are two traces to enable to look for this condition. The first one will show if the all the needed user attributes have been retrieved. If this is false, then a full fetch of the user information will occur. The second trace shows which attributes are being requested, so you can tell which ones should be added to the base set.

The two trace strings are:

```
com.ibm.wps.um.PrincipalImpl=all=enabled
com.ibm.wps.um.PumaProfileImpl=all=enabled
```

Enable those traces, and then execute the use case you wish to test. Then, look for this message in the trace.log:

```
PrincipalImpl 3 com.ibm.wps.um.PrincipalImpl isCompletelyLoaded false
```

This message may be output multiple times for the same user, so check all occurrences of it. If the value after isCompletelyLoaded is always true, then all the needed attributes have already been loaded, and no changes are needed. In this example, the value after isCompletelyLoaded is false, showing that the needed user attributes haven’t all been loaded. This will result in reloading all the user information from the user directory.

In that case, the trace will then typically show a call to reload the information for that user; this will tell the full distinguished name of the user whose information is being loaded from the user directory:

```
PrincipalImpl > com.ibm.wps.um.PrincipalImpl reload ENTRY id: cn=Yin Yin_000_992,
cn=users,l=SharedLDAP,c=US,ou=Lotus,o=Software Group,dc=ibm,dc=com
```

Next, search above that in the trace for the getAttributes call, which will show the attributes the user has requested. It will look like this:

```
PumaProfileIm > com.ibm.wps.um.PumaProfileImpl getAttributes ENTRY id: cn=Yin Yin_000_992,
cn=users,l=SharedLDAP,c=US,ou=Lotus,o=Software Group,dc=ibm,dc=com

...more user details follow...
        isExternal: false

        [preferredLanguage, ibm-primaryEmail, countryName, displayName, givenName, cn, sn, uid]
```

The last line of the log entry shows the attributes being requested. In this case, the attributes being requested are

[preferredLanguage, ibm-primaryEmail, countryName, displayName, givenName, cn, sn, uid].

Comparing this against the list of base user attributes, we can see that countryName is not in the base user attributes. Depending on whether the action being executed is a common one or not, consider adding this to the base set of attributes.

Minimum Attribute Set

Generally, the minimum set of attributes does not need to be modified from the default provided by HCL Portal, as that attribute set is satisfactory for the user management applications provided with HCL Portal. However, if your site contains a custom application for managing users and groups, and it uses attributes other than those in the minimum set, then you should consider expanding the minimum attribute set.

Fine Grained Access Control

By default, Portal applies access control for user and group lookups. For a user to retrieve this type of information, they would typically need access to a portlet, such as the out-of-the-box Users and Groups admin portlet, which makes PUMA API calls to look up user and group information. Second, they would require access rights, the User role or higher, on the users and groups they will retrieve. In other words, Portal Access Control (PAC) is doing filtering based on access control over the individual users and groups, in addition to the access for the portlet.

This fine-grained access control may not be necessary in every customer's case, and it has a performance cost associated with it. If your access-control use cases are such that you do not require this fine-grained access control over the users and groups, then you can turn off the fine-grained access control checks, and get a performance benefit. **However, you need be aware of the resulting exposure of user and group information if you turn off the fine-grained access control checks.**

There are 2 access paths through Portal to the user and group information: Via the Users and Groups administration portlet, and via the PUMA REST remote API interface. (Technically there is also a 3rd and 4th, via custom code written and deployed on your Portal instance that uses the PUMA API or directly written to the VMM API. We will ignore those possibilities, which involve the development and deployment of custom code, for this discussion).

In the case of a portlet, the access to the portlet acts as a 'gatekeeper' from an access control perspective, for the user and group information. In order to access the portlet, the user has to have sufficient permissions. A portlet that uses the AdminPumaHome API can get a performance benefit from turning off the fine-grained access checks described here, and the security model is then that access to the portlet implies access to any and all user and group information.

In the case of JavaScript that accesses the PUMA REST service, there is no gatekeeper. In that case it is only safe to disable the fine-grained access checks **if** it is acceptable for the PUMA REST service to provide access to all users and groups to anyone able to make such a REST service call.

To turn off these fine-grained access control checks, the store.puma_default.disableACforRead property needs to be set to true.

How to Set

In the Integrated Solutions Console
Resources → Resource Environment → Resource Environment Providers → WP PumaStoreService → Custom Properties → New

Name: store.puma_default.disableACforRead
Value: true

Use of Dynamic Content Features

HCL Portal contains dynamic content support infrastructure which supports two dynamic content features: dynamic user interfaces and attribute based administration. If neither of these features is being used, the dynamic content support can be disabled. Note that attribute based administration is only one use of the Personalization capabilities in WebSphere Portal. Other uses of Personalization, such as placing content spots within a portlet, do not require the dynamic content features.

Disabling the dynamic content features will provide a modest performance benefit. It will provide a reduction in the memory needed for each user and also will reduce the processing time for generating pages in HCL Portal. For example, in one measurement with our base Portal scenario, capacity improved about 5% when disabling the dynamic content support.

How to Set

In the Integrated Solutions Console
Resources → Resource Environment → Resource Environment Providers → WP ConfigService → Custom Properties → New

Name: content.topology.dynamic
Value: false

Personalization Best Practices

HCL Portal Personalization lets you choose content for users, based on information in their profiles and on business rules. More information about Personalization is available in the Portal Information Center, under the topic “Personalizing your content”.

If your site is using Personalization, you’ll want to make sure you’re getting the best possible performance as well. Performance information is presented in the Performance section of the HCL DX Help Center: https://help.hcltechsw.com/digital-experience/8.5/pzn/pzn_publish_considerations.html

Real-World Network Considerations

In our lab environment, our clients and servers were on the same LAN segment, so they could take advantage of a high-bandwidth, low-latency network connection. This is typically not the case for real deployments. Over a wide-area network, latencies can be significant, and bandwidth limited. In this case, the time to transfer the page content from the server to the client can become a significant contributor to overall page response time.

Here are some steps which can help alleviate this situation:

- Compress content on the HTTP server. See the Content Compression on the HTTP Server section for more information.
- Allow client-side caching of images, Javascript files, and stylesheets, See the Adding Cache Headers in IHS for more information.

Social Rendering

Social rendering enables Portal page editors to feature social data that is hosted on a remote IBM Connections server in the context of Portal pages.

As social rendering is based on the WCM Rendering Portlet, the same performance tunings for WCM rendering should be applied.

On a pure rendering system we enabled the ListRenderingCache in order to reduce CPU consumption and improve performance. In addition to enabling the cache you need to change your presentation template and appearance components to reference this cache. For more details, see https://help.hcltechsw.com/digital-experience/8.5/social/soc_rendr_adm_socl_list.html

The other caches used by social rendering include the BeanListCache and DocumentCache which are enabled by default. Additional tuning was not required.

Secure Sockets Layer (SSL)

If possible, all traffic to the Portal server should be unencrypted. SSL should only be used between the client browser and front end servers such as firewalls or web servers. Benchmarks show no regression when SSL is used between the client and IHS, even when SSL is used on unauthenticated pages. However, the same benchmark showed an 11% drop in throughput when SSL was enabled between the web server and Portal.

If SSL must be enabled on the Portal server, ensure that this server supports Intel's Advanced Encryption Standard New Instructions (AES-NI). To make use of the instructions, the Java system property com.ibm.crypto.provider.doAESInHardware must be set to true. Without this setting, the throughput was more than 16% less with SSL enabled on Portal. For more information see http://www-01.ibm.com/support/knowledgecenter/SSYKE2_7.0.0/com.ibm.java.security.component.70.doc/security-component/JceDocs/aesni.html.

See https://help.hcltechsw.com/digital-experience/9.5/security/ssl.html for information on setting up SSL. Also review this article on the HCL DX Q&A

Forum

https://hclpnpsupport.hcltech.com/community?id=community_question&sys_id=dffb0af11be54c9c77761fc58d4bcb0e for information on terminating SSL at the web server.

Tagging & Rating

Database Fetch Size

For sites with a large number of tags, the performance of the Tag Cloud Portlet may become unacceptable. To fix this, change the number of database rows that are fetched by each call to the database. The optimal value depends on the number of tags and the usage patterns of the system. For 50,000 tags, the fetch size was increased to 500.

How to Set

In the WebSphere Integrated Solutions Console
Resources → Resource Environment → Resource Environment Providers → WP DataStoreService

Name: <domain>.datasource.fetchsize
Value: 500

Note <domain> is one of the Portal database domains. Public tags are stored in the comm domain; private tags are stored in the cust domain.

WebSEAL

IBM Security Access Manager is a robust and secure centralized policy management solution for e-business and distributed applications. IBM Security Access Manager WebSEAL is a high performance, multi-threaded Web server that applies fine-grained security policy to the Security Access Manager protected Web object space. WebSEAL can provide single sign-on solutions and incorporate back-end Web application server resources into its security policy.

General installation and configuration instructions can be found at Configuring Security Access Manager.

WebSEAL provides several security mechanism for providing SSO services, however, our performance effort specifically on LTPA.

LTPA

In the LTPA mechanism WepSphere shares its LTPA keys with the WebSEAL server. WebSEAL then negotiates with the client browser using LTPA cookies. This relieves the WebSphere server of all user authentication exchanges. The setup for this mechanism is discussed in Single signon to IBM WebSphere (LTPS).

Tuning

Redirecting Portal Login Link

Our WebSEAL server was configured to pass all pages visited by unauthenticated users and to invoke SSO when users attempt to visit authenticated pages. All of the Authenticated pages have URLs prefixed with /wps/myportal/. On the first visit to any page with this URL structure, WebSEAL will load the SSO login page. To prevent the appearance of two logins (WebSEAL followed by Portal) it is recommended to redirect the Portal Login page to /wps/myportal.

How to Set

Modify the content of the JSP file <ServerRoot>/PortalServer/theme/wp.theme.themes/default85/installedApps/DefaultTheme85.ear/DefaultTheme85.war/themes/html/dynamicSpots/commonActions.jsp.

Find the <%-- Login Link --%> section and change the highlighted fields in this part of the file from this: <a href='<% wpsURL.write(escapeXmlWriter); %>'...

To this: <a href='/wps/myportal'...

Save the file and restart Portal.

Worker Threads

The worker-threads setting was changed to support more concurrent users during the benchmark measurements.

How to Set

1. Edit <pdweb install>/etc/webseald-default.conf
2. Change the property worker-threads to 1000 (default 100)
3. Save the configuration and restart WebSEAL

RA Compression

By default the Portal server GZIPs the theme resources, then the WebSEAL server unzips them for internal use. It would be more efficient for Portal to leave them unzipped and allow WebSEAL GZIP them when it is ready.

How to Set

1. Configure Portal to **not** compress ra:collection URLs
   a. In the WAS admin console navigate to Resources → Resource Environment Providers → WP ConfigService → Custom properties
      Create a new property:
      Name: com.ibm.wps.resolver.servlet.ContentHandlerGzip.mime-type.exclude
      Value: ^.*$
   b. Save the configuration and restart Portal
2. Configure WebSEAL to compress ra:collection URLs
   a. Edit <pdweb install>/etc/webseald-default.conf
   b. In the [compress-mime-type] section add text/* = 1000
   c. Save the configuration and restart WebSEAL

Installing a Fixpack

Best practice is to create your own theme based on the theme that HCL Portal ships. If you use the shipped themes instead of creating your own, some tuning you applied will get overwritten when a cumulative fix is applied.

After installing a cumulative fix, the tuning to commonActions.jsp will need to be reapplied.
In addition, the default theme profile and the login portlet's theme profile is overwritten. If you are using customized theme profiles, those customizations will need to be re-applied after installing a cumulative fixpack.

HCL Portal Caching

Caching, storing frequently accessed data rather than constantly generating or retrieving that data, is of critical concern for Portal performance. Caches in Portal are used to reduce response times for results that are expensive to calculate or avoid a slow network connection.

Rendering a Portal page requires loading the theme and one or more portlets to generate the resulting HTML. Portlets, and Portal itself, make calls to backend databases and LDAP. Rendered Portal pages are sent through one or more network connections, any of which could be slow. These network connections could include a content delivery network (CDN) one or more proxy servers, firewalls or other security appliances. Finally, the end user's browser will display and render the page.

Each of these steps may require a substantial amount of processing time. The network could also be a bottleneck for users on slower connections. As a result, Portal performance will require many layers of caching for optimal performance.

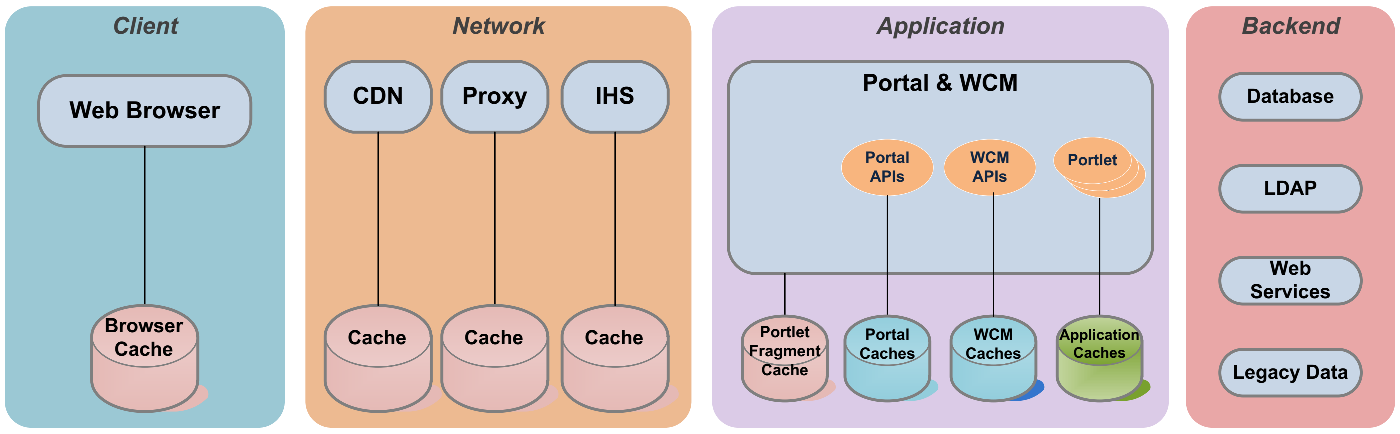


Figure 6 Portal Caching Layers

In general, the closer the data is to an end user, the faster the response time and the more performant Portal will be. Caching requests at the front end will also reduce the number of requests that Portal itself actually has to serve. This will save CPU processing and allow higher overall throughput.

Browser Caching

Web browsers cache HTTP responses in internal memory or disk caches. Subsequent requests for the same URLs will be served from these caches. When served from cache, no network requests will be made. This is the best performing option since content is already on the user's local computer.

In order for the browser to cache content, it must include Cache-Control headers. Portal will include these headers for static content it served from the theme (ra:collection URLs). Other static content that is not part of the theme (e.g. custom portlet images) will not have these headers applied. IHS can be configured to automatically apply these headers. See the Adding Cache Headers in IHS section for instructions.

Default Cache-Control Headers

By default, Portal adds Cache-Control headers to all resources served from the theme and WebDAV. Theme URLs will include ra:collection; WebDAV URLs will include /dav/fs-type1. By default these items will be publically cachable for 1 day. These settings can be changed in the WP ConfigService Resource Environment Provider. For the specific properties, see https://help.hcltechsw.com/digital-experience/9.5/dev-theme/themeopt_mod_adminmod.html for theme content and https://help.hcltechsw.com/digital-experience/9.5/admin-system/mash_webdav_store.html for WebDAV.

HTTP & Proxy Server Caching

Most web servers, including IHS, are capable of caching HTTP responses just like browser caches. However, since these caches are shared by many end users, only responses with Cache-Control: public will be cached.

IHS will use a disk cache for this data, if properly configured. See the IHS as a Caching Proxy section for information on how to do this. Configuring proxy servers and other content delivery systems is outside the scope of this document.

Content Compression

While not directly related to caching, content compression, usually via GZIP, on HTTP servers is also critical for performance since it reduces the amount of bandwidth and thus the time taken to send an HTTP response across the network. See the Content Compression on the HTTP Server section for more information on this topic.

Note that theme resources (ra:collection URLs) in Portal are compressed at startup by Portal. Portal pages and other content are not compressed.

When using compression, care must be taken to ensure that only a single server tier is attempting to compress responses. Certain combinations of HTTP headers, particularly Vary and Auth headers, and security configurations may cause intermediate security and proxy servers to uncompress and recompress HTTP responses. The causes delays and adds unnecessary additional processing overhead.

Adaptive Page Caching

Browsers will cache content with either Cache-control: public or Cache-Control: private headers. Private is usually used to indicate dynamic content that should be viewed only by a single user. While most content in Portal is dynamic, it does not, by default, add public or private cache headers to primary Portal responses since pages are assumed to be dynamic.

If Portal content can be cached for some period of time, it should be. Even caching for a few minutes can dramatically reduce the load in some cases. But, since HTTP servers do not have any application awareness and cannot cache private content, adding the correct Cache-Control headers needs to be done in Portal.

Portal can apply the appropriate Cache-Control headers through its Adaptive Page Caching mechanism. Adaptive Page Caching is done by specifying caching properties at the page and portlet level. If caching parameters are specified for multiple portlets, the most restrictive cache scope and timeout will be applied to the entire page. See https://help.hcltechsw.com/digital-experience/9.5/security/tune_cache.html for more information.

Portlet Fragment Cache

Depending on processing requirements, it may be beneficial to cache the HTML output of an individual portlets on a page. Portlets that make requests to slow backends or have high processing requirements are good candidates for fragment caching. Note that Performance measurements with and without fragment caching are recommended to see if this feature provides any benefit under real-world conditions.

Fragment caching is useful when a only a single portlet on a page is dynamic. In this case, the entire page cannot have a Cache-Control header (set with Adaptive Page Caching) since that will prevent the dynamic content from being updated. But, there is no need to regenerate the content of the portlets that do not change. So, the static portlets' content can be cached to improve performance of the page overall.

Portlet Fragment Caching leverages the underlying WebSphere Servlet Fragment Cache. So, this service must be enabled first. Then, the Portlet Fragment Cache can be enabled. Once enabled, individual portlets must be configured to enable caching for each portlet.

How to Set

1. Enable servlet caching
   In the WebSphere Integrated Solutions Console
   Servers → Server Types → WebSphere application servers → WebSphere_Portal → Web Container Settings → Web container
   Check Enable servlet caching
2. Enable portlet fragment caching
   In the WebSphere Integrated Solutions Console
   Servers → Server Types → WebSphere application servers → WebSphere_Portal → Portlet Container Settings → Portlet container
   Check Enable portlet fragment caching
3. Restart the Portal Server
4. Change the portlet cachability settings
   a. For standard portlets, login to Portal as an administrator and navigate to Portal administration page. Select Portlet Management → Portlets. Find the portlet you want to configure and click the Configure portlet button to load the portlet settings.
   b. For WCM Rendering Portlets, go into edit mode and load the portlet menu. Select either Configure or Edit Shared Settings from the dropdown in the upper part of the portlet. With Configure, the settings apply to all instances of WCM Rendering Portlets. With Edit Shared Settings, the settings only apply to the one instance of the portlet.

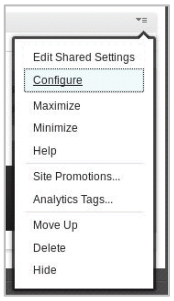
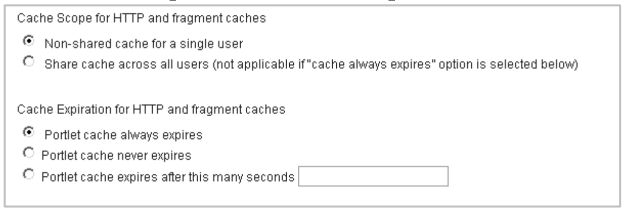


Figure 7 WCM Rendering Portlet Configuration

5. Select the appropriate Cache Scope and Cache Expiration for the portlet.



Cache Scope for HTTP and fragment caches

[✓ Non-shared cache for a single user]
Share cache across all users (not applicable if "cache always expires" option is selected below)

Cache Expiration for HTTP and fragment caches

[✓ Portlet cache always expires]
Portlet cache never expires
Portlet cache expires after this many seconds

Figure 8 Portlet Cache Options

Cache Scope

Shared Cache across users

This type of cache provides the biggest performance improvement as it caches the output of the rendering portlet across users. This cache scope should be used only for rendering portlets that render Web content that is not personalized.

Non-shared cache for a single user

This type of cache provides a smaller performance improvement but allows caching of personalized Web content that is displayed by the rendering portlet.

Expiration

Cache always expires

The content will never be cached in either a shared or a private portlet cache (i.e. this setting disables the cache).

Cache never expires

The content can be stored indefinitely in either a shared or a private portlet cache.

Cache expires after this many seconds: The content will be stored for the number of seconds specified in either a shared or a private portlet cache

Monitoring

WebSphere Application Server comes with a Cache Monitor application that allows you to monitor your cache to make sure it is working properly. In addition, there's an extended cache monitor with more functionality and additional bug fixes.

How to Set

1. Install/Update the Cache Monitor. For information on how to do this, go to: http://www.ibm.com/developerworks/websphere/downloads/cache_monitor.html.
2. Before you can access the Cache Monitor application, you will need to give an administrator account access to this application.
   In the WebSphere Integrated Solutions Console
   Applications → Application Types → WebSphere enterprise applications → Dynamic Cache Monitor → Security role to user/group mapping → Select "administrator"
   Click on Map Users
   Search for the right user account and add it to the "selected" box
   Click OK
   Click Save
3. Login to the Cache Monitor application. The URL should look like http://myserver.com:<port>/cachemonitor.

4. Select the “baseCache” and click OK
5. At this point any WCM Web Content Viewer JSR 286 portlet with caching enabled should add entries to this cache.
6. To look at the contents of the cache, simply click on the “Cache Content” link on the left side menu.
7. In addition to viewing the contents of the cache, you can also use the Cache Monitor application to view cache statistics, invalidate individual cache entries, and compare cache content.

Note that the Cache Monitor application will also allow you to view Portal and WCM caches. However, the information displayed is not specific to Portal. The Portal Cache Viewer, mentioned below should be used for monitoring Portal and WCM caches.

Application Caching

WebSphere provides built in functionality for caching Java objects, DynaCache. Custom portlets can use DynaCache and its DistributedMap interface to programmatically store and retrieve custom Java objects. This is especially useful for caching data from backed sources like databases or legacy applications.

For more information see:
http://www-01.ibm.com/support/knowledgecenter/SSEQTP_8.5.5/com.ibm.websphere.base.doc/ae/tdyn_distmap.html

Portal Caching

Internally, Portal uses a number of DynaCache instances to cache data from the Portal user databases and LDAP. Tuning the sizes of these caches can improve performance. See the Cache Manager Service sections for the cache sizes use in base Portal performance measurements. For a description of the various Portal caches, see the Base Portal Cache Instances section.

WCM Caching

For many functions, WCM utilizes the same caches as base Portal. In addition, there are also WCM specific caches. These are documented in the WCM Cache Instances section.

The WCM Rendering Portlet can also take advantage of Portlet Fragment Caching. See the Portlet Fragment Cache section above on how to enable this for a specific WCM Rendering Portlet.

Internal Portal Caches

Previous chapters described the specific values we modified for the WebSphere Portal caches in our environments. This section describes the HCL Portal caches, the general parameters for those caches and which cache instances HCL Portal 8.5 provides.

General Information

With HCL Portal 8.5, Portal configuration properties, including cache configuration properties, are managed via the WebSphere Integrated Solutions Console. In previous WebSphere Portal releases these configuration properties were maintained in properties files. More information on how to modify Portal configuration properties can be found in the Overview of configuration services section of the HCL Digital Experience Portal Version 8.5 information center.

Cache Configuration Properties

The cache configuration properties are organized in two groups: global configuration properties and cache instance specific properties. Global properties have the prefix cacheglobal and apply to all caches unless they are specifically overridden with a cache instance specific property. Cache instance specific properties have the prefix cacheinstance and then contain the name of the cache instance and the name of the property, for example:
cacheinstance.com.ibm.wps.ac.PermissionCollectionCache.size

All entries of a cache are governed by a single set of properties. The cache configuration properties that are safe to modify are: enabled, lifetime, size, shared, replacement, and admit-threshold. The replacement and admit-threshold properties do not apply to all cache implementations. In general, only caches that are not shared will use these properties. There are other properties that should not be modified unless specifically instructed to do so by IBM WebSphere Portal support.

Enabled

The enabled property determines whether a cache is used or not. If a cache is not enabled, the property has a value of false, then no values are held by the cache and every cache lookup will return a null value. This property should be modified only for testing purposes, never in a production environment. The supported values are true and false and the global default value is true.

Lifetime

The lifetime property determines the number of seconds an entry will exist in a cache. A cache no longer returns an entry once the entry has existed longer than the lifetime property. Cache entries can also be invalidated prior to reaching their lifetime due to explicit invalidation of the entry or Least Recently Used (LRU) eviction from the cache.

A value of -1 indicates an infinite lifetime. This value should be used with caution since cache entries will only be invalidated programmatically. Infinite lifetimes are particularly discouraged with access control caches because:

In a cluster there can be rare occurrences when not all cache invalidation messages are processed on every node due to race conditions in the application server's DynaCache code. While the probability of this occurring is very low, finite lifetimes allow these entries to be invalidated when there are application errors.

Finite lifetimes allow modifications made to roles, which have been externalized to an External Security Manager, to be reflected in role caches.

If updates to production environments are restricted to a well defined staging process using XML Access, it is usually safe to use infinite lifetimes.

Size

The maximum number of entries in a cache is limited by the size property. If this size limit is reached, entries are removed from the cache by an algorithm which usually includes 1) remove invalidated entries and entries which have exceeded their lifetime and 2) apply a LRU algorithm to the valid entries.

Any positive integer is allowed. Cache sizes have a direct impact on the memory requirements of your Portal, specifically the demands on the Java heap. You should monitor and record the Java heap metrics and any performance impact when modifying the size of a cache.

Shared

Cluster-aware caches are *shared* across the nodes of a cluster. These caches propagate invalidations of cache entries by using the WebSphere Application Server DistributedMap interface provided by DynaCache.

Supported values are true and false. The default values shipped in HCL Portal 8.5 should apply to most configurations. If you do not have a cluster there may be a small performance benefit to setting this property to false since a different cache implementation is used. We did not modify the defaults in our single node measurement environments.

If this parameter is false in a cluster, it can ultimately lead to data inconsistencies between the cluster members.

Replacement

The cache replacement algorithm used by these caches works on the frequency of recent access to cache entries; entries that have been used frequently are less likely to be discarded than entries that have not been used frequently. This parameter controls how long the access history will be kept. A setting of aggressive means those only recently accessed entries will be considered, which causes stale entries to be discarded more quickly. The opposite setting, conservative, will consider a longer access history. The intermediate setting of moderate is appropriate for most caches.

Admit Threshold

Caches that have a very high insert rate may cause useful entries to be discarded prematurely. An admittance threshold restricts the rate at which entries are allowed into the cache by only allowing them to enter after an attempt has been made to insert the same entry into the cache multiple times. The default value of 0 means “no admittance threshold”, which will allow entries into the cache on the first insert attempt. This is appropriate for most caches. A higher value indicates that a cache entry will not be allowed into the cache until that many attempts have been made to insert the same key. For example, a value of 2 means that the first two attempts to insert a cache entry will be ignored, and the third attempt will insert the value into the cache. We did not modify the admit-threshold for any cache in our measurement environments.

Cache Usage Patterns

Most HCL Portal caches follow the simple paradigm: if an entry already exists use it, otherwise add the entry. However, there are caches that behave differently. Each cache follows one of the following five patterns:

Regular

The regular pattern is the most common cache pattern:

```
value = cache.get(key);
if (value == null) {
  value = calculateNewValue();
  cache.put(key, value);
}
```

Invalidation Checking

Invalidating cache entries in a clustered environment is rather expensive. Therefore, Portal caches often check whether the entry to be invalidated actually exists in the local cache.

```
value = cache.get(key);
if (value != null) {
  cache.invalidate(key);
}
```

Caches following this pattern follow the regular pattern for all but invalidation actions.

Multiple Object Types

Most caches hold only a single object type. When caches can hold multiple types, they follow the regular pattern for each of those types.

Cache Combination

Some caches are wrapped and combined into one single physical WebSphere Application Server DynaCache instance to reduce administrative overhead of monitoring and managing several similar cache instances that have similar configurations. The single cache instance is configured with a 'wrapped' setting that specifies the physical instance that shall be used for storage, for example, cacheinstance.com.ibm.XYZCache.wrapped=com.ibm.CommonPhysicalCacheInstance. Only CommonPhysicalCacheInstance will be managed and monitored.

Cascading Object Types

This pattern is a special case of the ‘multiple object types’ pattern in that two or more object types that are queried in a certain order are stored in a single cache. There may be one cache hit along with a cache miss on a regular basis.

```
value = cache.get(keyA);
if (value == null) {
  value = cache.get(keyB);
  if (value == null) {
   value = calculateNewValue();
   cache.put(keyA || keyB, value);  // either key could be used
  }
}
```

First Level Caches

In many hardware and software architectures, caches are often organized into hierarchies. For some Portal caches, typically WebSphere DynaCaches, “first level caches” are defined which can improve performance, especially if many cache retrievals for a limited set of values are performed.

In special, performance critical situations, performance may improve significantly when defining first level caches or increasing the sizes of first level caches and cache miss caches. You should do this with care and only if you have a test setup where you can measure the performance of your Portal system.

Two kinds of first level caches exist in the current version of Portal:

Implicitly defined first level caches.

Explicitly defined first level caches.

For a DynaCache used by Portal, an implicit first level cache or an explicit first level cache can be defined but not both. You can change the size of a first level cache or disable it but you should not replace an explicit first level cache by an implicit first level cache or vice versa.

In WebSphere Portal, DynaCaches are used as distributed caches, that means if on one node of a Portal cluster, a key-value pair is deleted in a DynaCache, then invalidation events are sent to the other nodes to remove obsolete key-value pairs from both, the DynaCaches and the first level caches of the other nodes.

Implicitly Defined

The definition of such a cache is fairly simple. For a base cache, the size of the first level cache is defined. Take the cache com.ibm.wps.pe.portletentity as an example. Here, with the configuration property cacheinstance.com.ibm.wps.pe.portletentity.firstLevelCacheSize=5003, a first level cache with size of 5003 is defined for the cache com.ibm.wps.pe.portletentity.

This first level cache essentially consists of an array which can hold up to 5003 key-value pairs. When storing a key-value pair in the first level cache, by use of a hashing algorithm, the array index is computed. That means when having two different key-value pairs with the same hashed index, only one of these pairs can be stored in the implicit first level cache. A consequence of this fact is that it is unlikely that this first level cache gets filled up with entries.

In the "Simple table format" displayed by the Portal Cache Viewer, for com.ibm.wps.pe.portletentity, the following two caches are listed:

- com.ibm.wps.pe.portletentity first level cache
- com.ibm.wps.pe.portletentity second level cache

That means the base cache has the attribute "second level cache" to distinguish it from the first level cache.

Explicitly Defined

With explicit caches, multiple caches are defined in the Portal configuration:

1. A DynaCache
   This is the base cache which is also responsible for propagating invalidations in the cluster in case a key-value pair is updated.
2. A first level cache
   As with implicitly defined first level caches, this cache helps to improve the performance in case many gets for a restricted set of key-value pairs is performed.
3. An optional cache for cache misses
   Sometimes, it is critical to efficiently check that no value exists for a key. A specially designed cache, the “cache misses cache” can improve the performance.

As example, consider the following three caches:
1. com.ibm.wps.resolver.data.cache.DataSourceCache as the base DynaCache.
2. com.ibm.wps.resolver.data.cache.FirstLevelDataSourceCache as first level cache.
3. com.ibm.wps.resolver.data.cache.CacheMissDataSourceCache as cache misses cache.

Then, caches are referenced by setting additional configuration properties
cacheinstance.com.ibm.wps.resolver.data.cache.DataSourceCache.firstLevelCache=
com.ibm.wps.resolver.data.cache.FirstLevelDataSourceCache
and
cacheinstance.com.ibm.wps.resolver.data.cache.DataSourceCache.cacheMissCache=
com.ibm.wps.resolver.data.cache.CacheMissDataSourceCache

This explicitly defines the first level cache and the cache misses cache.

The "Simple table format" of the Portal Cache Viewer does not show the relationships of explicitly defined first level caches. Instead you can use the "Table format with details". There is displayed the following information:
"com.ibm.wps.resolver.data.cache.DataSourceCache of type DistributedMapCache wrapped by: SecondLevelCache.
The SecondLevelCache uses com.ibm.wps.resolver.data.cache.FirstLevelDataSourceCache as first level cache
and com.ibm.wps.resolver.data.cache.CacheMissDataSourceCache as cache miss cache."

Disable a Cache

To save memory, first level caches can be disabled. Implicit first level caches are disabled by setting the size to 0. Explicit first level caches are disabled by setting the name of the first level cache to a null value.

For example, to switch off an implicit first level cache:

```
cacheinstance.com.ibm.wps.pe.portletentity.firstLevelCacheSize=0
```

However, to disable an explicit cache

```
cacheinstance.com.ibm.wps.resolver.data.cache.DataSourceCache.firstLevelCache=
```

Where the value after the equals is blank, signifying a null string.

Note that if you disable an explicit first level cache, the cache miss cache is also disabled. To disable only the cache miss cache without disabling the explicit first level cache, you need to set the value of the cacheMissCache property to null. For example:

```
cacheinstance.com.ibm.wps.resolver.data.cache.DataSourceCache.cacheMissCache=
```

In many scenarios, the performance may degrade only marginally when disabling all first level caches.

Combiner Caches

In WebSphere Portal 8, HCL DX 8.5 and higher releases, some PAC and model caches are consolidated into a single combiner cache. For reference, here are the sets of caches that were combined into new caches in WP8. The name in *blue* is the new cache name. The names underneath the new cache, are the set of caches from WP7 that were combined and no longer exist in WP8.

com.ibm.wps.ac.CommonApplicationRoleMgmt

- com.ibm.wps.ac.ApplicationRoleForApplicationUserCache
- com.ibm.wps.ac.MappedRolesToUserCache
- com.ibm.wps.ac.ApplicationRoleOIDCache
- com.ibm.wps.ac.ApplicationRoleDescriptorCache
- com.ibm.wps.ac.ApplicationRolesForPrincipalCache
- com.ibm.wps.ac.ApplicationRoleChildrenCache
- com.ibm.wps.ac.ApplicationRoleMappingsCache
- com.ibm.wps.ac.ContainedRolesCache

com.ibm.wps.ac.CommonRolesCache

- com.ibm.wps.ac.RolesCache
- com.ibm.wps.ac.ParentResourceRoleMappingCache
- com.ibm.wps.ac.ResourceRoleMappingCache

com.ibm.wps.ac.CommonExplicitEntitlementsCache

- com.ibm.wps.ac.ExplicitEntitlementsCache
- com.ibm.wps.ac.ExplicitEntitlementsCache.CONTENT_NODE
- com.ibm.wps.ac.ExplicitEntitlementsCache.PORTLET_APPLICATION_DEFINITION
- com.ibm.wps.ac.ExplicitEntitlementsCache.PORTLET_DEFINITION
- com.ibm.wps.ac.ExplicitEntitlementsCache.USER_GROUP
- com.ibm.wps.ac.ExplicitEntitlementsCache.VIRTUAL
- com.ibm.wps.ac.ExplicitEntitlementsCache.WEB_MODULE
- com.ibm.wps.ac.ExplicitEntitlementsCache.WSRP_PRODUCER

com.ibm.wps.ac.groupmanagement.CommonUserGroupMgmt

- com.ibm.wps.ac.groupmanagement.NestedGroupCache
- com.ibm.wps.ac.groupmanagement.GroupCache
- com.ibm.wps.ac.groupmanagement.PeerGroupCache

For HCL DX 8.5, this cache was split back into com.ibm.wps.ac.groupmanagement.GroupCache and com.ibm.wps.ac.groupmanagement.NestedGroupCache for performance reasons. com.ibm.wps.ac.groupmanagement.PeerGroupCache was used for the Application Infrastructure feature, which is no longer supported.

com.ibm.wps.puma.CommonPrincipalCache

com.ibm.wps.puma.OID_User_Cache
com.ibm.wps.puma.OID_Group_Cache
com.ibm.wps.puma.DN_Group_Cache
com.ibm.wps.puma.DN_User_Cache

com.ibm.wps.model.factory.UserSpecificModelCache

com.ibm.wps.model.factory.ContentModelCache.live
com.ibm.wps.model.factory.ContentModelCache.isolated
com.ibm.wps.model.factory.NavigationSelectionModelCache.live
com.ibm.wps.model.factory.NavigationSelectionModelCache.isolated
com.ibm.wps.model.factory.NavigationModelCache.live
com.ibm.wps.model.factory.NavigationModelCache.isolated

Base Portal Cache Instances

This section describes the caches in HCL Portal 8.5 along with hints to best configure those caches. As see in previous sections, which detail the modifications made for performance benchmarks, the size and lifetime properties are the most commonly modified properties when tuning Portal caches. You may wish to increase the size of a cache if many values are used on a regular basis and there is sufficient space available in the Java heap. You may wish to increase the lifetime of the entries of a cache if the cached data rarely changes and it is not critical to your business to reflect changes immediately in your Portal. The changes mentioned in this section are either set in the Resource Environment Provider section of the WebSphere Integrated Solutions Console or are set in the file CacheManagersService.properties. For instructions on configuration caches, see the Cache Manager Service section in base Portal tuning.

Each cache description includes the following attributes:

Default size, default lifetime and cache usage pattern
Cache content and scaling factor(s) (i.e. what causes the cache to grow)
Information on the read and write access to the cache
Approximate costs for re-creating cache entries and relative size of cached objects. Small objects range from 16 to 300 bytes and the largest cache entries are not larger than a few thousand bytes. One exception is the access control caches in systems with many resources per user. These caches can hold entries that are 50KB or more since they contain information on all the resources which a user can access.
Some cache descriptions include a sample scenario with suggested property values.

Access Control

This section describes each of the access control caches. It is critical for proper operation of a Portal that the access control information be current. Hence it is vital that these caches be shared within a cluster so that the information is propagated to all members of the cluster. Different lifetime values should be chosen to avoid concurrent reload of information from multiple caches. This pattern of rather random lifetime and invalidation intervals could also be applied to other caches.

Figure 9 shows the relationships among the various caches. The cylinders represent cache instances. The gray caches are caches of the Portal user management (PUMA) component that are closely related to the caches of the Portal access control component. The PUMA caches contain information originating from the user registry. Portal access control uses these caches for user identification and group membership retrieval.
The vertical axis represents the cache aggregation direction. The cache instances in higher layers leverage cache instances of lower layers to compute their values. For example, when computing effective permissions (entitlements) for a user (cached in the ExplicitEntitlementsCache), the Portal access control component leverages cache values from the ChildResourcesCache and RoleMappingCache.

Note that some of the depicted cache instances are not visible nor configured directly as they were combined in Portal 8.0 (e.g. see CommonUserGroupMgmt and CommonRolesCache).

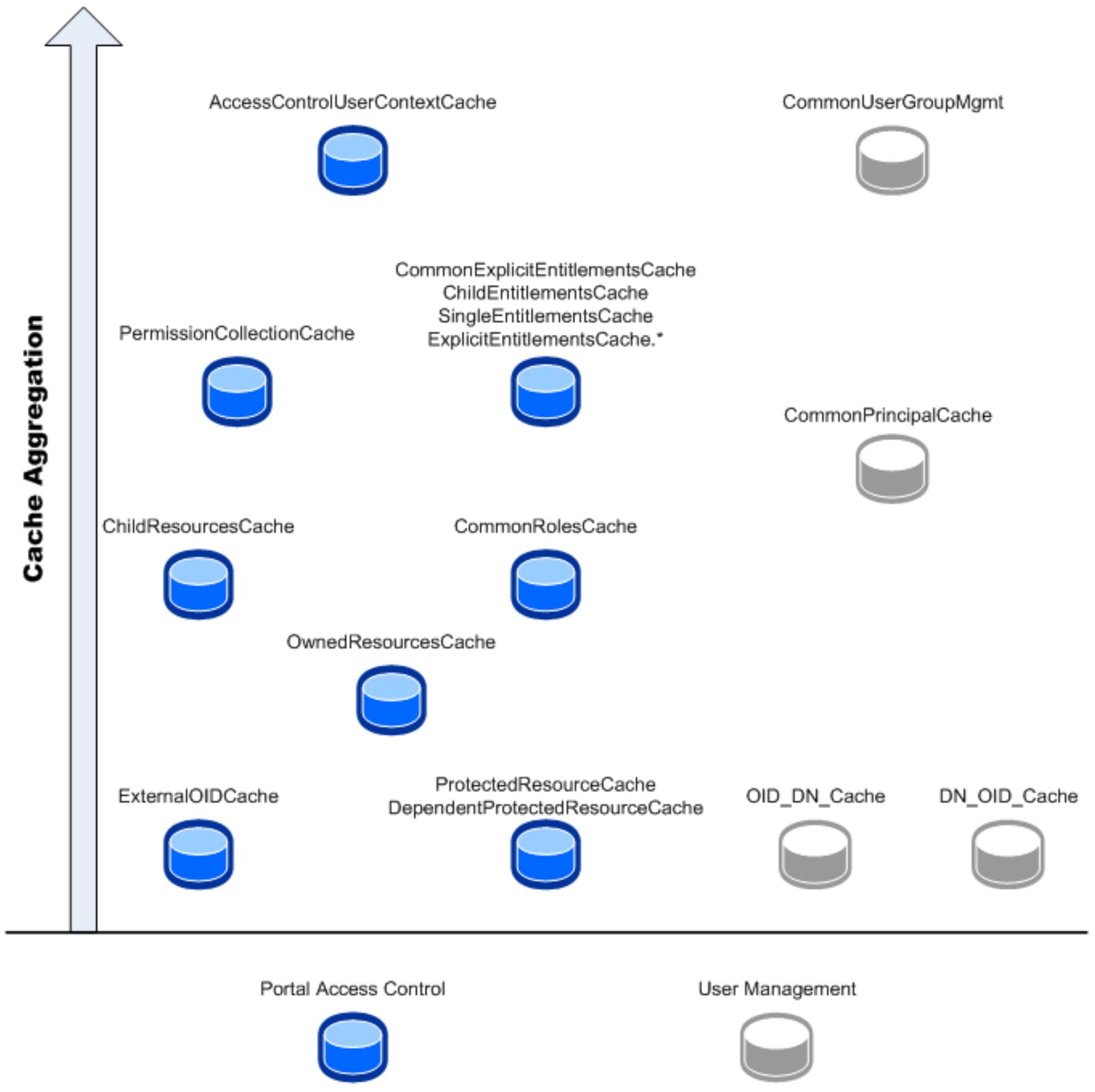


Figure 9 Portal Access Control Cache Hierarchy

com.ibm.wps.ac.AccessControlUserContextCache

Default size: 6000, default lifetime: 1200, usage pattern: regular.

This cache contains the access control user context objects, a local cache for permissions assigned to a specific user. If possible all requests against access control are answered using this information so that access control methods can return very quickly. This cache scales with the number of active users. For fast Portal operation, you should make sure that the entries for all actively working users fit into the cache, especially if a user has access to many Portal resources. Entries are invalidated from the cache upon any Portal administrative action. Creating a cache entry typically is rather cheap because most information is in memory, but can take a while if the required information cannot be found in other caches. An entry in the cache can be become very large, depending on the number of resources the user can access.

com.ibm.wps.ac.ChildResourcesCache

Default size: 10000, default lifetime: 28800, usage pattern: regular.

This cache contains the resource hierarchy within Portal access control. The size of this cache scales with the number of protected resources accessed by the active users in the system, like the protected resources cache. This cache does not contain leaf objects in the access control tree, so the number of entries typically is smaller. The cache is accessed during most Portal access control requests. Entries are invalidated from this cache during resource deletion, parent change of the resource, modification of the resource owner, externalization, internalization, and role block change. Creating a cache entry includes a multi-row query against the Portal database. An entry in the cache is fairly small.

com.ibm.wps.ac.CommonApplicationRoleMgmt

Default size: 30000, default lifetime: 8450, usage pattern: physical cache instance for the following caches:

com.ibm.wps.ac.ApplicationRoleForApplicationUserCache
com.ibm.wps.ac.MappedRolesToUserCache, com.ibm.wps.ac.ApplicationRoleOIDCache
com.ibm.wps.ac.ApplicationRoleDescriptorCache
com.ibm.wps.ac.ApplicationRolesForPrincipalCache
com.ibm.wps.ac.ApplicationRoleChildrenCache
com.ibm.wps.ac.ApplicationRoleMappingsCache
com.ibm.wps.ac.ContainedRolesCache

This physical cache instance holds all entries from application role specific cache wrapper instances.

com.ibm.wps.ac.CommonExplicitEntitlementsCache

Default size: 33000, default lifetime: 28800, usage pattern: physical cache instance for the following caches:

com.ibm.wps.ac.ExplicitEntitlementsCache
com.ibm.wps.ac.ExplicitEntitlementsCache.CONTENT_NODE
com.ibm.wps.ac.ExplicitEntitlementsCache.PORTLET_APPLICATION_DEFINITION
com.ibm.wps.ac.ExplicitEntitlementsCache.PORTLET_DEFINITION
com.ibm.wps.ac.ExplicitEntitlementsCache.USER_GROUP
com.ibm.wps.ac.ExplicitEntitlementsCache.VIRTUAL
com.ibm.wps.ac.ExplicitEntitlementsCache.WEB_MODULE
com.ibm.wps.ac.ExplicitEntitlementsCache.WSRP_PRODUCER

This physical cache instance holds all entries from selected entitlements specific cache wrapper instances. More specifically, these caches contain the permissions of a user or group on a number of resources of the same ResourceType. There are dedicated caches for the different ResourceTypes. For example, the cache for pages is called com.ibm.wps.ac. ExplicitEntitlementsCache.CONTENT_NODE. All ResourceTypes that are not specified explicitly will be cached in the default cache. The size of this cache scales with the number of active users/groups multiplied by the different ResourceTypes valid for this cache and accessed by the users and groups, either by 'using' the resource during navigating the Portal or by Portal administration. There is one entry per set of permissions per WebSphere Portal domain. Entries are read during 'regular' access control requests, during page rendering and, especially, during Portal administration. If a certain resource type is not used, you will see only misses and no other activity on the corresponding cache.

Entries are invalidated from this cache during all access control modifications and logins. Creating an entry in one of these caches typically can be done from in-memory information in the lower-level caches. If the required information is not available multiple database requests might be required to create a cache entry. An entry into the cache is rather small, but built of multiple objects typically stored in other caches.

com.ibm.wps.ac.CommonRolesCache

Default size: 40000, default lifetime: 28800, usage pattern: physical cache instance for the following caches:

com.ibm.wps.ac.RolesCache
com.ibm.wps.ac.ParentResourceRoleMappingCache
com.ibm.wps.ac.ResourceRoleMappingCache

This physical cache instance holds all entries from roles specific cache wrapper instances. Specifically, those caches contain the access control role instances. The size of an individual cache scales with the number of active users/groups multiplied by the different ResourceTypes they access. There is one entry per role instance per principal per resource type per HCL Portal domain. Data is read from the cache during many Portal access control requests, if the corresponding entitlements are not already cached. Entries are invalidated from this cache during role mapping creation, role mapping deletion, resource deletion, externalization, and internalization. Creating a cache entry means executing at least one, but potentially multiple database queries. An entry in the cache is relatively small.

com.ibm.wps.ac.ProjectDeletedResourcesCache

Default size: 1000, default lifetime: infinite (-1), usage pattern: regular

This cache stores authorization information about pages which are defined outside the project and have been deleted as part of a project. This cache contains the project identification and the database domain identification. Since there are two possible domains, release or jcr, the maximum number of cache entries is twice the number of projects.

Note that in Portal 8, this cache was combined into the com.ibm.wps.ac.CommonProjectResourcesCache.

com.ibm.wps.ac.ProjectDraftResourcesCache

Default size: 1000, default lifetime: infinite (-1), usage pattern: regular

This cache stores authorization information is about draft pages created in a project. This cache contains the project identification and the database domain identification. Since there are two possible domains, release or jcr, the maximum number of cache entries is twice the number of projects.

Note that in Portal 8, this cache was combined into the com.ibm.wps.ac.CommonProjectResourcesCache.

com.ibm.wps.ac.DataEventPropagationCache

This is a special purpose cache that is used especially for Portal access control cache invalidation communication. **Do not change its configuration!**

com.ibm.wps.ac.DependentProtectedResourceCache

Default size: 10000, default lifetime: 14400, usage pattern: regular.

The protected resource caches contain the resources protected by Portal access control. The size of these caches scale with the number of protected resources accessed by the active users in the system. The DependentProtectedResourcesCache is used by WCM content item resources only, while the ProtectedResourcesCache does hold resources for various Portal resource types. Entries are read from the cache during every permission call or entitlements call against access control. Entries are invalidated from this cache during resource deletion, resource relocation, and modification of the resource state (private/shared), modification of the resource owner, externalization, internalization, and role block change. Creating a cache entry requires a single-row lookup in the Portal database. An entry in the cache is relatively small.

com.ibm.wps.ac.ExplicitEntitlementsCache.*

Default size: 10000, default lifetime: varying (around 10000), usage pattern: invalidation checking.

Includes

com.ibm.wps.ac.ExplicitEntitlementsCache.ICM_CONTENT.dyn
com.ibm.wps.ac.ChildEntitlementsCache
com.ibm.wps.ac.SingleEntitlementsCache

These caches contain additional access control data that is not directly cached in the com.ibm.wps.ac.CommonExplicitEntitlementsCache. These caches are dedicated to specialized resource types and uncommon use cases. Typically, only some or none of those caches are filled during a typical scenario as the majority of data is already cached in the CommonExplicitEntitlementsCache.

com.ibm.wps.ac.ExternalOIDCache

Default size: 28800, default lifetime: 8640, usage pattern: regular.

This cache contains the mapping between the external ObjectIDs of individual protected resources, for example page or portlet IDs, and the Portal access control specific ObjectIDs stored in the database table PROT_RES. Entries are read from the cache during many Portal access control requests. The size of this cache scales with the number of protected resources accessed by the active users in the system. Since this mapping is immutable, this cache is never explicitly invalidated. Creating a cache entry requires a single row database query. An entry in the cache is fairly small.

com.ibm.wps.ac.groupmanagement.CommonUserGroupMgmt

Default size: 5000, default lifetime: 3600, usage pattern: physical cache instance for the following caches:

com.ibm.wps.ac.groupmanagement.NestedGroupCache
com.ibm.wps.ac.groupmanagement.GroupCache
com.ibm.wps.ac.groupmanagement.PeerGroupCache

For WP8.5, this cache was split back into com.ibm.wps.ac.groupmanagement.GroupCache and com.ibm.wps.ac.groupmanagement.NestedGroupCache for performance reasons. com.ibm.wps.ac.groupmanagement.PeerGroupCache was used for Application Infrastructure, which is no longer supported.

com.ibm.wps.ac.groupmanagement.GroupCache

Default size: 5000, default lifetime: 3600, usage pattern: regular

GroupCache is used in an HCL Portal when nested groups are disabled. This cache contains the direct groups to which a user belongs. The size of this cache scales with the number of active users and the number of virtual Portals they access. The cache is accessed during login into Portal, but typically not during regular Portal navigation. Its main use case is during administration of users and user groups. Entries are invalidated from this cache after user and group administrative changes. Creating a new cache entry requires queries against the VMM component and then typically against the user repository. An entry in the cache is medium-sized.

com.ibm.wps.ac.groupmanagement.NestedGroupCache

Default size: 5000, default lifetime: 3600, usage pattern: regular

NestedGroupCache is used in a WebSphere Portal when nested groups are enabled. This cache contains the nested groups to which a user belongs. The size of this cache scales with the number of active users and the number of virtual Portals they access. The cache is accessed during login into Portal, but typically not during regular Portal navigation. Its main use case is during administration of users and user groups. Entries are invalidated from this cache after user and group administrative changes. Creating a new cache entry requires queries against the VMM component and then typically against the user repository. An entry in the cache is medium-sized.

com.ibm.wps.ac.OwnedResourcesCache

Default size: 5000, default lifetime: 28800, usage pattern: invalidation checking.

This cache maps resource owners (user groups or individual users) to the resources they own. This cache scales with the number of active users/groups multiplied with the different ResourceTypes they access. There is one entry in the cache per principal per resource type per HCL Portal domain. Data is read from this cache during many Portal access control requests, if the corresponding entitlements are not already cached in an entitlements cache. Entries are invalidated from this cache during resource deletion, modification of the resource owner, and externalization. Creating a cache entry means executing a multi-row query against the Portal database. An entry in the cache is relatively small.

In many scenarios, there is no benefit from this cache and it can be disabled. In other scenarios, it may be beneficial but only with cache sizes near the default. Larger cache sizes can make performance worse. *Performance testing is required to determine the benefit of this cache for a specific use case and data population.*

com.ibm.wps.ac.PermissionCollectionCache

Default size: 2000, default lifetime: 14400, usage pattern: regular; admit-threshold:2

This cache contains permission collections that can be used for permission checks. It scales with the number of permissions in the system, i.e. the number of Portal resources and permissions assigned on those. Entries in the cache typically are requested very frequently during permission checks. An admit-threshold is used to avoid caching rarely used permissions. You may wish to try different admit-threshold settings to tune this cache. Entries are never invalidated from the cache. Creating a cache entry is very fast since all required information is in-memory. A cache entry is small.

com.ibm.wps.ac.ProtectedResourceCache

Default size: 5000, default lifetime: 14400, usage pattern: regular.

This cache contains the resources protected by Portal access control. The size of this cache scales with the number of protected resources accessed by the active users in the system. Entries are read from the cache during every permission call or entitlements call against access control. Entries are invalidated from this cache during resource deletion, resource relocation and modification of the resource state (private/shared), modification of the resource owner, externalization, internalization, and role block change. Creating a cache entry requires a single-row lookup in the Portal database. An entry in the cache is relatively small.

Datastore

The datastore caches contain data read from the Portal database. The goal of these caches is not to be a complete image of the DB content, but to have frequently-accessed but raw information available for all other Portal components to use.

com.ibm.wps.datastore.pageinstance.DerivationCache

Default size: 3000, default lifetime: infinite (-1), usage pattern: regular.

This cache stores the mappings between pages and their derivation children, or empty mappings if no such children exist. Like the pageinstance.OIDCache cache this one also is accessed very frequently during page rendering and administration. Creating a cache entry involves one multi-row database query. This cache also scales with the number of pages in the system. Hence, you can use the same sizes for com.ibm.wps.datastore.pageinstance.OIDCache and this one. In most Portal usage scenarios the actual size of this cache will be somewhat lower than the page instance cache. An average entry in the cache is rather small. Only if all your pages have long lists of derivation children will the entries become larger. To achieve best performance, in terms of cache hit rate, the size should be set to a value so that all pages defined in the system fit into the cache. This corresponds to the combined row count of the PAGE_INST database tables in the release, community and customization databases.

com.ibm.wps.datastore.pageinstance.DynamicNodeCache

Default size: 5, default lifetime: infinite (-1), usage pattern: regular.

This cache stores one list per virtual Portal. These lists contain all pages in the corresponding domain that are flagged as dynamic nodes, i.e. dynamic assembly content nodes can be added below these pages. Since the number of domains does not grow, the size scales with the number of virtual portals. The cache size should be #Virtual Portals * 3+ 3. The size of one entry into the cache ranges from small in a Portal with very few dynamic nodes up to medium with many dynamic nodes in the system.

com.ibm.wps.datastore.pageinstance.MetaDataCache

Default size: 499, default lifetime: 3600, usage pattern: regular

This cache stores information relevant for retrieving pages based on page parameters. The primary use case that benefits from this cache is retrieving the individual target pages from friendly URLs.

The size of the cache scales with the number of friendly URLs defined and used in Portal.
The entries in this cache are rather small.

com.ibm.wps.datastore.pageinstance.OIDCache

Default size: 3000, default lifetime: infinite (-1), usage pattern: regular.

This cache stores information on Portal pages for fast retrieval during login or page navigation. It scales with the number of page instances in the system. It is one of the most frequently used caches and should be large enough to hold all pages that are frequently accessed by users. Pages are loaded and put into the cache by direct navigation, creating a link to another page or by working with the page during Portal administration (always including all higher derivation levels). Creating a cache entry includes four multi-row database lookups. An entry to the cache is medium sized. To achieve best performance, in terms of cache hit rate, the size should be set to a value so that all pages defined in the system fit into the cache. This corresponds to the combined row count of the PAGE_INST database tables in the release, community and customization databases.

com.ibm.wps.datastore.pageinstance.OIDDraftCache

Default size: 500, default lifetime: infinite (-1), usage pattern: regular.

This cache stores information on Portal draft pages for fast retrieval during login or page navigation. It scales with the number of draft page instances in the system. It should be large enough to hold all draft pages that are frequently accessed by users. Draft pages are loaded and put into the cache by direct navigation, creating a link to another page or by working with the page during Portal administration (always including all higher derivation levels). Creating a cache entry includes four multi-row database lookups. An entry to the cache is medium sized. To achieve best performance, in terms of cache hit rate, the size should be set to a value so that all draft pages defined in the system fit into the cache. This corresponds to the row count of the PAGE_INST_DRAFT database table in the release database.

com.ibm.wps.datastore.portaliddescriptor.VPIDCache

Default size: 200, default lifetime: infinite (-1), usage pattern: regular.

This cache maps long virtual portal object IDs to the corresponding Portal internal short ID and vice versa. It scales with two times the number of virtual portals in the system, plus two additional entries. Data is read from the cache during every rendering request.

For optimal caching the size should be set to twice the number of Virtual Portals defined in the system plus two entries. Creating a cache entry involves one single-row database lookup. An entry object into the cache is fairly small.

com.ibm.wps.datastore.services.Identification.OidAndUniqueName.cache

Default size: 5000, default lifetime: infinite (-1), usage pattern: regular.

This cache stores unique names. It is used quite frequently during page rendering and especially administration of unique names. Page and portlet unique names make up the biggest part of the cache content. The cache should be large enough to hold entries for the most frequently used pages and portlets having a unique name associated with them. Note that not all resources have a unique name associated with them. To eliminate database lookups the cache size could correspond to the database table UNIQUE_NAME multiplied by two, to allow for mapping in two directions. Creating a cache entry involves reading one entry from the Portal database. An entry object into the cache is fairly small.

com.ibm.wps.datastore.services.Identification.SerializedOidString.cache

Default size: 5000, default lifetime: infinite (-1), usage pattern: cascading object types.

This cache stores serialized ObjectIDs used in request parameters or XML Access files. It contains a subset of all the loaded ObjectIDs in memory. It scales with the number of ObjectIDs in the system, but the serialized version of all of these IDs are not requested, hence the actual size is impossible to predict. The cache is used during every request. Creating a cache entry is rather cheap. Typically all information can be retrieved in memory, database lookups are scarcely necessary. A cache entry is fairly small.

Dynamic Assembly / Process Integration

The following caches are used when dynamic UI functionality, often together with WebSphere Process Server integration are used.

processintegration.PendingTasksCache

Default size: 2500, default lifetime: infinite (-1), usage pattern: regular.

This cache contains the pending process tasks in the scope of a user. The size of this cache scales with the number of users concurrently using process integration functionality. Each cache entry consists of a complete set of pending process tasks for a given user and therefore can be fairly large in memory. Reloading a cache entry involves accessing the Human Task Manager via an EJB call. The cache is always accessed when the PendingTasksTag is used in a portlet JSP.

You should also configure the setting processintegration.pendingtasks.lifetime in ConfigServices.properties which defaults to a value of 30 seconds. This setting describes the interval at which a process engine is queried for pending tasks of a user and the cache entries are updated.

wp.te.transformationAssociationCache

Default size: 500, default lifetime: infinite (-1), usage pattern: regular.

This cache contains transformation extension nodes. So typically there are only few entries in the cache. There is typically one access to the cache per request. Building an entry to the cache involves one database query. One entry is fairly small. Typically there is no need to modify the settings for this cache.

Model

The model caches can be categorized into two groups. One group is for caching assembled models as a whole (for example, com.ibm.wps.model.factory.UserSpecificModelCache). The other group is for caching information within a model, for example, caching a ContentPage.

Figure 10 describes the hierarchy of caches in the model component and depending Portal components. The structure of the picture is identical to Figure 9. The vertical axis shows caches with increasing aggregation of data.

The model component only caches data at a rather high aggregation level. As a result, all data cached here hence is rather valuable and reloads can be expensive if the corresponding data is not available in the lower-level caches. Model caches are dependent upon the datastore and Portal access control caches. The figure only features the most important caches.

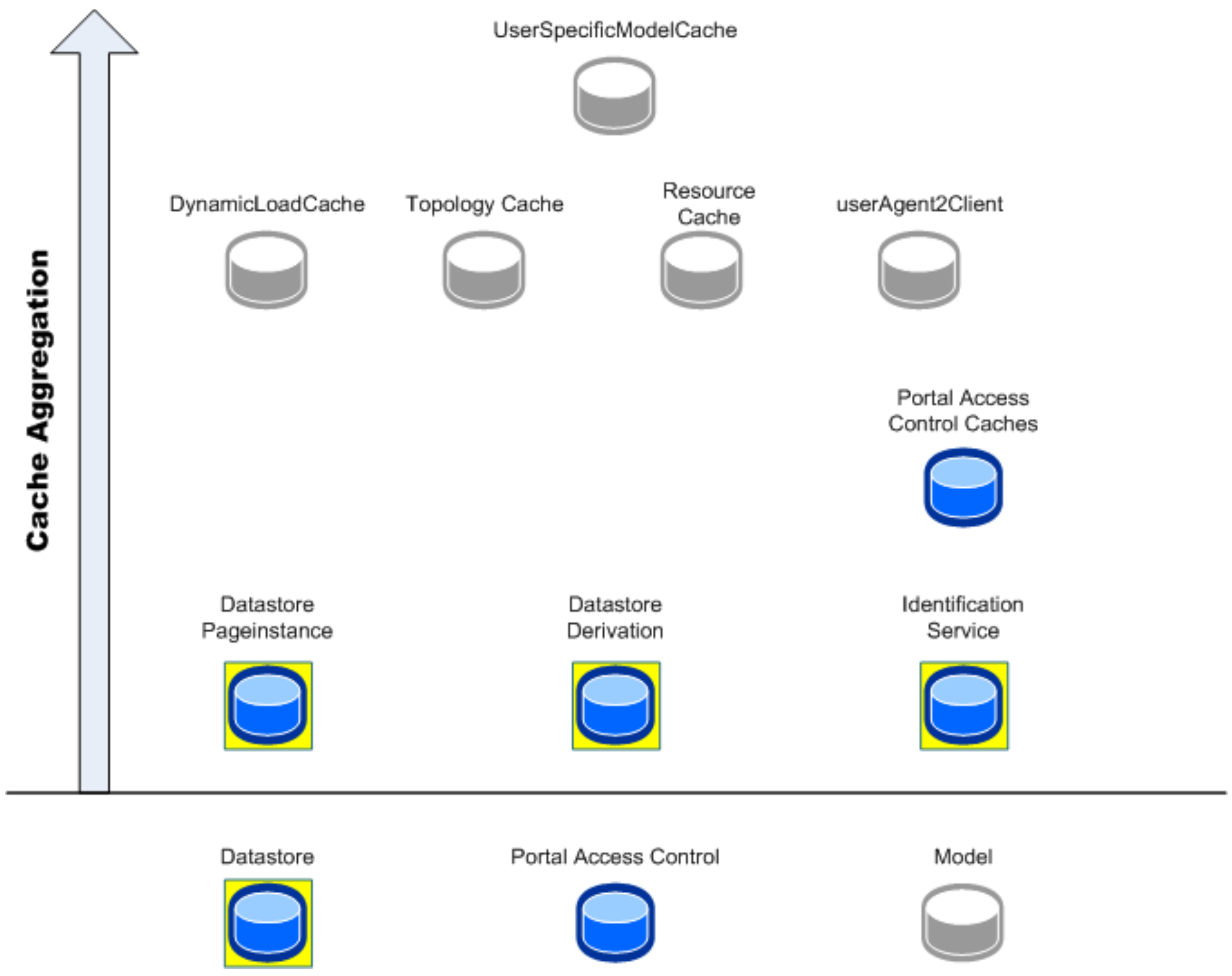


Figure 10 Portal Model Cache Hierarchy

com.ibm.wps.model.admin.ListModelCache

Default size: 25, default lifetime: 86400, usage pattern: regular.

This cache stores a very limited amount of items and is properly invalidated, so changing its size or lifetime will probably not provide a performance benefit.

com.ibm.wps.model.admin.skin.SkinListCache.themestoskin

Default size: 1000, default lifetime: 86400, usage pattern: regular

This cache stores the association of skins to themes. The optimal size correlates with number of themes in use by Portal.

com.ibm.wps.model.admin.skin.ThemeScopedSkinListCache

Default size: 200, default lifetime: 86400, usage pattern: regular

Do not change the configuration of this cache. It caches a single item and is properly invalidated, so changing size or lifetime will not improve performance.

com.ibm.wps.model.content.impl.DynamicLoadCache

Default size: 10, default lifetime: 86400, usage pattern: regular.

This cache contains all content nodes which represent extension nodes for dynamic assembly. In an unmodified installation, this is only node, the "Content Root", which has the PZN dynamic assembly associated with it. Other nodes are root nodes for SAP integration or Dynamic UI.

com.ibm.wps.model.content.impl.ExplicitOidCache

Default size: 5000, default lifetime: 86400, usage pattern: regular

This cache is used to store the explicit derivations of a content node (Portal Page). The optimal size correlates with number of pages defined in the Portal.

com.ibm.wps.model.content.impl.InternalUrlBacklinkCache

Default size: 5000, default lifetime: 10000, usage pattern: regular

This is a legacy cache that is only active for Mashups.

com.ibm.wps.model.content.impl.ResourceCache

Default size: 5000, default lifetime: 5600, usage pattern: regular.

This cache contains aggregated pages. In contrast to the data store page instance cache this cache contains the complete models of pages and their content, i.e. the portlets and containers on them. In contrast, the page instance cache holds the raw page data. This cache scales with the number of pages defined in your Portal and the different sets of access control rights on these pages. This cache contains very 'valuable' information; it uses several other caches, for example, page instance and access control caches, to build its data. Hence creating a cache entry usually only requires in-memory information, but can also lead to many database queries. The size of an entry in the cache depends on the complexity of the pages, but typically the objects are medium-sized, since they are usually made of references to other cached data. The cache should be large enough to hold the most frequently accessed pages multiplied with the number of different access control settings on these pages. Increasing the cache lifetime can be useful if page definitions do not change often in your environment.

Example: A portal has 500 pages and all users have the same permissions on these. In addition, there are another 50 pages; two groups of users have different access rights on these pages. In this case a maximum of 600 entries would be in the cache.

com.ibm.wps.model.content.impl.UnknownTopologiesCache

Default size: 50, default lifetime: 15000, usage pattern: regular.

This cache stores a very limited amount of items and is properly invalidated, so changing its size or lifetime will probably not provide a performance benefit.

com.ibm.wps.model.content.impl.TopologyCache

Default size: 10000, default lifetime: 5700, usage pattern: regular.

This cache contains Portal topology information, i.e. Portal navigation elements being composed of navigation nodes and their sorted, access-control-filtered children. Topology elements undergo several processing steps. First they are loaded from the database. Eventually they get added to the cache. This cache contains only the completely processed topology entities. This cache is explicitly used during login and whenever a user navigates to a part of the Portal where he has not been before during the same session. If a cache entry is not found, a private copy is created that is then further processed. Once the private copy is completely processed – that does not happen for all navigation nodes – it is added to the cache. If a user finds an entry in the cache a reference is copied into his private topology model and additional cache accesses are no longer necessary. Hence there is only one cache hit (or miss) per user and navigation node. The cache scales with the number of navigation nodes and the number of different sets of permissions on these and, possibly, the derivation chain (children and parents) a page belongs to. Entries in this cache are expensive to create; they rely on other cached information, like the access control caches and the page instance cache. The entries in the cache are medium sized, being mainly some lists of references to other cached data. The cache should be sized in a way such the most important pages multiplied with all the different sets of permissions that exist on theses page can be stored.

com.ibm.wps.model.factory.public.pages.update

Default size: 100, default lifetime: infinite (-1), usage pattern: regular.

Do not change the configuration of this cache. It caches a single item and is properly invalidated, so changing size or lifetime will not improve performance.

com.ibm.wps.model.factory.SingletonModelCache

Default size: 100, default lifetime: infinite (-1), usage pattern: regular.

This cache stores a very limited amount of items and is properly invalidated, so changing its size or lifetime will probably not provide a performance benefit.

com.ibm.wps.model.factory.UserSpecificModelCache

Default size: 6000, default lifetime: 19000, usage pattern: regular.

In this cache all models for all users are cached. Besides models that are user dependent, there are models such as the ContentModel, which are session, markup and deviceclass dependent. Thus the number of entries in this cache scales with the number of concurrently logged in users on one cluster node, multiplied by the number of markups and device classes. Additional entries are created if a user logs in more than once. A user logged in more than once has more than one session. The additional sessions cause more entries to be added to the cache. In addition, if many users are interacting with the Portal administrative pages the number of entries will be doubled.

Typically users have 4 models at maximum on a system where only rendering is taking place.

com.ibm.wps.model.impl.RuntimeClientMap.patternCache

Default size: 100, default lifetime: 86400, usage pattern: regular.

This cache stores the regular expression pattern for each client pattern. The optimal size correlates with number of configured clients (See Portal Administration > Portal Settings > Supported clients).

com.ibm.wps.model.impl.RuntimeClientMap.userAgent2client

Default size: 250, default lifetime: infinite (-1), usage pattern: regular.

This cache maps user agent strings, i.e. the identification strings sent by browsers in the HTTP header, to client profiles. These profiles basically correspond to Composite Capability/Preference Profiles (CC/PP) profiles. Hence the cache scales with the number of browser identification strings. Data from this cache is accessed during every request. Creating a cache entry is very cheap since the profile information is in memory already. An entry in the cache hence is fairly small since already existing data is referenced.

com.ibm.wps.model.portlet.PortletPoolCache
This cache is for future use and can be disabled. It will be disabled by default in a future Cumulative Fix (CF).

Policy

The HCL Portal policy manager uses the following caches.

com.ibm.wps.mpages.ActiveProjectOIDCache

Default size: 50, default lifetime: uses globally configured default lifetime, usage pattern: regular.

This cache contains all ObjectIDs of active projects. Its semantic is more like a set than a map as it is used to check if the ObjectID of a project maps to an active project. If that information is not obtained through the cache, i.e., a cache miss, then some expensive WCM calls possibly including JCR calls, have to be executed. The cache size scales with the number of active projects. Cache entries are very small. If no projects are used at all, e.g., in a rendering-only system then this cache can be deactivated.

com.ibm.wps.mpages.ProjectNameUUIDCache

Default size: 100, default lifetime: uses globally configured default lifetime, usage pattern: regular.

This cache allows mapping from a project name to its UUID. If that information is not obtained through the cache, i.e., a cache miss, then some expensive WCM calls possibly including JCR calls, have to be executed. The cache size scales with the number of active projects. Cache entries are very small. If no projects are used at all, e.g., in a rendering-only system then this cache can be deactivated.

com.ibm.wps.mpages.ProjectUUIDNameCache

Default size: 50, default lifetime: uses globally configured default lifetime, usage pattern: regular.

This cache allows mapping from a project's UUID to its name. If that information is not obtained through the cache, i.e., a cache miss, then some expensive WCM calls, possibly including JCR calls, have to be executed. The cache size scales with the number of active projects. Cache entries are very small. If no projects are used at all, e.g., in a rendering-only system, then this cache can be deactivated.

com.ibm.wps.policy.services.PolicyCacheManager

Default size: 1000, default lifetime: 43200, usage pattern: regular.

This cache stores the policies. Out of the box, Portal comes with twelve theme policies and one mail policy, each of them being one entry into the cache. Hence the maximum number of cache entries depends on your system and the number of custom policies. This cache is accessed fairly often, if you use policies at all. The HCL Portal 8.5 default theme uses policies and query this cache during every request, but it is possible to create themes that do not use policies at all. Furthermore, when opening mails the cache is accessed. Creating a cache entry involves reading data from a database. An entry into the cache is fairly small.

com.ibm.wps.policy.services.UserPolicyNodeCacheManager

Default size: 2500, default lifetime: 600, usage pattern: regular.

This cache stores connections between a policy and a policy target, for example a user distinguished name. Theme policies do not use targets, hence there is no cache entry based on these policies. The out-of-the-box mail policy uses the user as target. Hence there is at least one entry for every user accessing the CPP mail portlet. The size of a cache entry depends on the size of the target object. For a distinguished name a cache entry is fairly small.
Project Caches

Portal User Management

The following caches are used by the Portal user management component (PUMA). They are closely related to the access control caches and caching within the WebSphere WIM and VMM functionality.

com.ibm.wps.puma.CommonPrincipalCache

Default size: 30000, default lifetime: 3600, usage pattern: physical cache instance for the combined caches com.ibm.wps.puma.* instances.

This physical cache instance holds entries from PUMA OID_User_Cache, OID_Group_Cache, DN_User_Cache and DN_Group_Cache. Those caches contain the mapping between the distinguished name / internal ObjectID of users and groups and their internal data object. The size of these caches scales with the number of active users and groups or users and groups that are used for delegation multiplied with factor 4 (as each entry is stored with different keys to enhance lookup). Entries are invalidated from this cache during deletion of a user or group. Creating an entry requires database and WIM/VMM access that may trigger further LDAP requests. An entry in the cache is fairly large.

com.ibm.wps.puma.DN_OID_Cache & com.ibm.wps.puma.OID_DN_Cache

Default size: 30000 & 5000, respectively, default lifetime: infinite (-1), usage pattern: regular.

These two caches contain the mapping between the distinguished name of users and groups and their internal ObjectID identifier. The size of these caches scale with the number of active users and groups or users and groups that are used for delegation. Entries are invalidated from this cache during deletion of a user or group. Creating an entry requires one database lookup. An entry into the caches is fairly small.

com.lotus.cs.services.domino.DominoService

Default size: 2000, default lifetime: 11080, usage pattern: regular.

This cache stores user-specific Domino information. It is used for HCL Sametime awareness functions. It scales with the number of users working with the corresponding function. The cache is accessed whenever awareness functions are requested during page rendering. Creating a cache entry is cheap and simply involves creating a new Domino session. An entry to the cache is medium-sized.

com.lotus.cs.services.UserEnvironment

Default size: 2000, default lifetime: 10880, usage pattern: regular.

This cache stores user-specific information. Entries represent a compilation of credential information for one user to different LDAP directories and details which data on the given user can be found in which directory. For example, the general info may be stored in one directory, but the mail server and file may be in another. The cache scales with the number of users working with Collaboration portlets. The cache is accessed whenever a Collaboration portlet such as for use with HCL Sametime is accessed. Creating a cache entry can be fairly expensive since multiple resources might be queried. An entry to the cache is medium-sized.

Digital Data Connector (DDC)

Portal uses the Digital Data Connector caches for Social Rendering. See https://help.hcltechsw.com/digital-experience/8.5/social/soc_rendr_perf_tune_cach.html for more information on the following caches.

com.ibm.workplace.wcm.pzn.plr.BeanListCache

Default size: 307, default lifetime: 900, usage pattern: regular

The bean list cache caches the bean list Java objects that the Digital Data Connector plug-ins return. The DDC plug-ins control the cache key generation for the individual entries and whether the bean lists are automatically removed from the cache during user login. By default, this cache is enabled.
Note: Single entries of this cache can have a size of several MB. Therefore, the default number of cache entries for this cache is much lower than the default of other portal caches. When you use the bean list cache, closely monitor the cache and tune it as required. You might also consider the size of individual cache entries and how to influence it. For more information, consult the HCL Digital Experience Social Rendering and Administration topics in the DX Help Center: https://help.hcltechsw.com/digital-experience/8.5/social/soc_rendr_adm_socl_list.html

com.ibm.workplace.wcm.pzn.plr.xml.DocumentCache

Default size: 3007, default lifetime: 900, usage pattern: regular

The document cache is used by the generic XML DDC plug-in for caching the Document Object Model (DOM) objects for individual source URIs. This cache specifically the DOMs for associated item attributes. If an individual associated item attribute is flagged as shared in the list-rendering profile, the cache entries are shared between different users. Such shared documents do not get invalidated on user login. Documents that are loaded through non-shared associated item attributes are cached separately per user. These cache entries are automatically invalidated during login. By default, this cache is enabled.

com.ibm.workplace.wcm.pzn.plr.ListRenderingCache

Default size: 3007, default lifetime: 900, usage pattern: regular

The list-rendering cache caches the markup that a specific appearance component generates for a specific bean list instance. If you enable this cache, updates in the appearance component might not become visible immediately, as updates to the corresponding IBM Web Content Manager design components do not invalidate this cache. In general, the entries in this cache are invalidated together with the corresponding bean list objects in the bean list cache listed earlier in this topic. As a result, it is good practise to disable this cache on authoring systems and enable it on delivery systems.

To use this cache, you must use the ListRenderingCache rendering plug-in to instrument the Web Content Manager design components that are involved in the markup generation for this cache. For more information see https://help.hcltechsw.com/digital-experience/8.5/social/soc_rendr_adm_socl_list.html

Mobile

com.ibm.wps.devicesupport.client2deviceclass

Default size: 25, default lifetime: infinite (-1), usage pattern: regular

This cache stores the list of device classes associated with a client as a list of ObjectIds. The recommended size is equal to the number of defined (and regularly) used clients in WebSphere Portal.

com.ibm.wps.devicesupport.profile2deviceclass

Default size: 25, default lifetime: infinite (-1), usage pattern: regular

This cache stores the list of device classes associated with a CCPP client profile as a list of ObjectIds. The recommended size is equal to the number of defined (and regularly) used clients in WebSphere Portal.

Outbound HTTP Connection Service

com.ibm.wps.outbound.datastore.ProxyConfigCache.values

Default size: 100, default lifetime: infinite, usage pattern: regular.

This cache stores the configuration settings for the Outbound HTTP Connection Service. The cache is used whenever a component that uses outbound HTTP Connection Service, such as the AJAX proxy is invoked. Cache entries are invalidated whenever changes to the outbound HTTP connections configuration are applied. To achieve best performance, the size of this cache should be bigger than the total number of configuration settings for outbound HTTP connections, which include:

All outbound connection profiles
All policy mappings, including one default mapping for each outbound connection profile
All policy rules
All cookie rules

In clustered environments, this cache must be shared, unless changes that are applied on the configuration settings of outbound HTTP connections are not required on all cluster nodes.

com.ibm.wps.outbound.datastore.ProxyConfigCache.topologies

Default size: 100, default lifetime: infinite, usage pattern: regular.

This cache stores the parent-child relations of configuration settings for Outbound HTTP Connection Service. The cache is used whenever a component that uses Outbound HTTP Connection Service, such as the AJAX proxy is invoked. Cache entries are invalidated whenever changes to the outbound HTTP connections configuration are applied. To achieve best performance, the size of this cache should be bigger than the total number of configuration settings for outbound HTTP connections.

In clustered environments, this cache must be shared, unless changes that are applied on the configuration settings of outbound HTTP connections are not required on all cluster nodes.

Personalization

Personalization has several different types of data that is stored in the JCR. Each one of these caches is used to store the corresponding nodetype:

```
services/cache/pzn/applicationObjects
services/cache/pzn/campaigns
services/cache/pzn/general
services/cache/pzn/jcrNodeTypes
services/cache/pzn/resourceCollections
services/cache/pzn/ruleMappings
services/cache/pzn/uuidPathConversions
```

The pzn/general is used for nodes such as those involved in select action result sets, the result sets themselves, etc; the other caches store individual types. These caches can be enabled/disabled, have their expirations, etc set in <wp_profile_root>/PortalServer/config/config/services/PersonalizationService.properties.

Page Management

The following caches are used primarily in page management scenarios.

com.ibm.wps.contentmapping.AuthoringCache

Default size: 1000, default lifetime: infinite (-1), usage pattern: regular

Caches the mapping between Portal pages and WCM Portal Page artifacts as used by the managed pages feature. This cache is primarily relevant on authoring systems with managed pages enabled.

com.ibm.wps.contentmapping.ContentMappingsCache

Default size: 1000, default lifetime: infinite (-1), usage pattern: regular

Caches web content page resolution results. Web content page resolution means dynamically retrieving the right portal page for rendering a given WCM content item or a IBM Connections resource. This resolution is typically performed when clicking on a link to a WCM content item (in the Web Content Viewer portlet, a Search result, or the Tag Center portlet) or a link to a IBM Connections resource in an IBM Connections portlet.

com.ibm.wps.contentmapping.ContentMappingInfoCache

Default size: 1000, default lifetime: infinite (-1), usage pattern: regular.

Caches the content mapping configuration (aka. page association configuration) for portal pages. This information is leveraged by the page associations dialog and other Portal administrative UIs.

com.ibm.wps.datastore.project.DraftedVersionExistsCache

Default size: 1000, default lifetime: uses globally configured default lifetime, usage pattern: regular.

This cache contains all ObjectIDs of pages for which a draft exists per project. It scales with the number of active projects. Creating a cache entry requires a database call that typically has to count all entries within an index. A cache value could be relatively big as it represents a list of ObjectIDs for all pages that are drafted in a project..

If no projects are used at all, e. g. in a rendering-only system then this cache can be deactivated.

Portlet Environment

The following caches are used to store various portlet definitions, configuration settings and attributes.

com.ibm.wps.pe.applicationregistry

Default size: 1000, default lifetime: 1800, usage pattern: regular.

This cache contains the portlet applications and the portlet definitions. This cache scales with the number of portlet applications, portlet definitions and portlet clones that are in active use in the system. Increasing the default lifetime can improve performance if portlet applications as well as portlet definitions and portlet clones change infrequently. Rebuilding the cache entries is rather expensive since it requires multiple database queries.

com.ibm.wps.pe.contenttypes.nocharset

Default size: 1000, default lifetime: infinite (-1), usage pattern: regular.

This cache contains content types in a specific format that is required by the portlet container. This cache is used to avoid the calculation and formatting of response content types that are set by a portlet during a portlet invocation. The cache scales with the number of different response content types.

By default cache entries do not expire, this setting should not be changed. Rebuilding cache entries does not include database access but is computation intensive.

com.ibm.wps.pe.contenttypes.result

Default size: 1000, default lifetime: infinite (-1), usage pattern: regular.

This cache contains content types in specific format that is required by the portlet container. The objects that are held in this cache have another format and are processed differently than the objects in cache com.ibm.wps.pe.contenttypes.nocharset. This cache is used to avoid the calculation and formatting of response content types that are set by a portlet during a portlet invocation. The cache scales with the number of different response content types.

By default cache entries do not expire, this setting should not be changed. Rebuilding cache entries does not include database access but is computation intensive.

com.ibm.wps.pe.deployedresources

Default size: 500, default lifetime: 15000, usage pattern: regular.

This cache contains web module information and servlet information which are associated with portlets. The cache scales with the number of deployed portlet web applications and portlets that are in active use in the system.

Increasing the default lifetime can improve performance if web applications as well as portlet definitions and portlet clones change infrequently. Rebuilding the cache entries is rather expensive since it requires multiple database queries.

com.ibm.wps.pe.portletentity

Default size: 10000, default lifetime: 28800, usage pattern: regular.

This cache contains configuration for portlets on pages (portlet instances, shared and per-user). It scales with the number of pages defined in your Portal, the number of portlets on the pages and the number of portlet instances that have been personalized by users. The cache is accessed many times during Portal page rendering. It is important that the most relevant portlet entities are cached. Creating a cache entry involves a single database lookup. An entry into the cache is fairly small.

Example: In a Portal with 500 pages and on average three portlets per page, the optimal cache size would be 1500 to store all possible portlet entity data in the cache, if users are not allowed to personalize the portlets. If the Portal has 100 users that are logged in concurrently and these users have personalized 50 portlets on average, the required cache size to cache all data would be 6500. These numbers give the maximum number of entries to the cache. Typically for this cache it is not required to have all portlet entities in memory, because most users will not view all pages so that not all personalized data must be loaded. The most frequently accessed un-personalized portlet entities should fit into the cache, though.

com.ibm.wps.pe.portletentitycounter

Default size: 2000, default lifetime: 1800, usage pattern: regular.

This cache contains an approximate number of personalized entities per shared portlet instance. It is used for heuristics to avoid database access when determining the portlet instance that is associated with a portlet window. The cache scales with the number of shared portlet instances that are in active use in the system.

Increasing the default lifetime can improve performance if portlet instances change infrequently. Rebuilding the cache entries is rather expensive since it requires multiple database queries.

com.ibm.wps.pe.portletmodel.portletdefinition

Default size: 1000, default lifetime: 1800, usage pattern: regular.

This cache contains portlet definitions. These definitions could be considered meta information about the deployed portlets. The cache scales with the number of portlet definitions that are in active use in the system.

Increasing the default lifetime can improve performance if portlet definitions change infrequently. Rebuilding the cache entries is rather expensive since it requires multiple database queries.

com.ibm.wps.pe.portletregistry

Default size: 1000, default lifetime: 1800, usage pattern: regular.

This cache contains portlet definitions. This cache holds objects of a different class compared with cache com.ibm.wps.pe.portletmodel.portletdefinition. The cache scales with the number of portlet definitions that are in active use in the system.
Increasing the default lifetime can improve performance if portlet definitions change infrequently. Rebuilding cache entries is rather expensive. It includes loading data from the database with several calls.

Resolver & Static Pages

com.ibm.wps.resolver.cor.cache.uri

Default size: 2000, default lifetime: infinite, usage pattern: regular

The cache caches java.net.URI objects based on their string representation. The cache values are small. The cache does not depend on the user, the virtual portal or the project.

com.ibm.wps.resolver.data.cache.CacheMissDataSourceCache

Default size: 10000, default lifetime: infinite, usage pattern: regular

This cache is used as a first level cache for caching data sources. Data is cached based on a combination of the URI of the data source and dependencies on request headers, so the same URI can appear multiple times in the cache. For every cache lookup, the system has to check for all possible variations of the URI in the cache. The CacheMissDataSourceCache speeds up this variation processing by caching the information that a particular variation is not part of the cache.

The cache only stores the cache keys, not cache values (the existence of the key in the cache implies a cache miss).

The size should be approximately twice as large as the size of the data source cache.

com.ibm.wps.resolver.data.cache.DataSourceCache

Default size: 10000, default lifetime: infinite, usage pattern: regular

This cache caches data sources on the server. The cache key is the URI of the data source and information about dependencies on request headers. Entries depend, in general, on the user, the project and the virtual portal. Primarily the cache is used to cache aggregated resources via the resource aggregator framework, but it might be used by applications as well, so general purpose predictions on the cache size are not possible.

The content of the cache can be viewed via http://portalserver/wps/mycontenthandler/distmap/ws/com.ibm.wps.resolver.data.cache.DataSourceCache.

The key into the cache is the URI of a data source. The value is the content of the data source, which can be anything from text files to binary data.

com.ibm.wps.resolver.friendly.cache

Default size: 1000, default lifetime: infinite, usage pattern: regular

The cache caches intermediate results during friendly URL processing. If friendly names are configured to be user specific, the size scales with the number of pages that have friendly names by the number of concurrent users. If friendly names are user independent, the cache scales only with the number of pages. The cache values are small.

Friendly names are not user specific if they are used only for pages that are public or pages that are shared by all users. If no user specific friendly names are used this cache can be made public by setting friendly.force.public to true in the WP ConfigService resource environment provider.

The content of the cache can be viewed via
http://portalserver/wps/mycontenthandler/distmap/ws/com.ibm.wps.resolver.friendly.cache

com.ibm.wps.resolver.resource.AbstractRequestDispatcherFactory

Default size: 20, default lifetime: infinite, usage pattern: regular

In the cache, Java objects of type javax.servlet.RequestDispatcher are stored. The cache keys are pairs of javax.servlet.ServletContext and a String object representing the resource path.

The request dispatcher is a J2EE tool to dispatch a request from one application to another application on the server. With caching, the request dispatchers obtained can be reused.

com.ibm.wps.spa.parser.locale.LocalizationParserCache

Default size: 1000, default lifetime: infinite, usage pattern: regular

The cache caches the processing of the locales in HTML files that represent the themes and skins. The size of the cache scales with the number of used themes and skins.

The cache values are medium sized.

The content of the cache can be viewed via http://portalserver/wps/mycontenthandler/distmap/ws/com.ibm.wps.spa.parser.locale.LocalizationParserCache.

com.ibm.wps.spa.parser.skin.SkinParserCache

Default size: 1000, default lifetime: infinite, usage pattern: regular

The cache caches the parsing of skins for dynamic spots. The size of the cache scales with the number of skins.

The cache values are medium sized.

The content of the cache can be viewed via http://portalserver/wps/mycontenthandler/distmap/ws/com.ibm.wps.spa.parser.skin.SkinParserCache.

com.ibm.wps.spa.parser.skin.ThemeParserCache

Default size: 1000, default lifetime: infinite, usage pattern: regular

The cache caches the parsing of themes for dynamic spots. The size of the cache scales with the number of themes.

The cache values are medium sized.

The content of the cache can be viewed via http://portalserver/wps/mycontenthandler/distmap/ws/com.ibm.wps.spa.parser.skin.ThemeParserCache.

Search

The following two caches are for internal usage and customers should not modify them. They are expected to be very small.

com.ibm.lotus.search.cache.dynacache.CacheServiceImp
- General purpose cache for search configuration objects, like search services.

com.ibm.lotus.search.siapi.search.imp.propertiesScope
- Cache for resolved scopes.

Social Rendering

Social data that is rendered on your Portal pages by using the social rendering feature is retrieved from a remote HCL Connections server. To reduce network traffic and improve performance, the data is cached on HCL Portal

Social rendering uses the Digital Data Connector (DDC) caches.

URL Mappings

The following caches contain data on Portal URL mappings. Be sure to size the caches in a way that these are large enough to hold all defined URL mappings in your system.

wps.mappingurl.ContextsCache

Default size: 500, default lifetime: infinite (-1), usage pattern: regular.

This cache contains URL mapping contexts. It scales with the number of mapping contexts defined in the system. This cache is used if a URL mapping cannot be resolved using the lookup cache. Creating an entry involves reading a mapping entry from the database. An entry in the cache is medium-sized.

wps.mappingurl.LookupCache

Default size: 600, default lifetime: infinite (-1), usage pattern: regular.

This cache is used as a final lookup cache for the computed mappings between (a hierarchy of) URL mappings and a WebSphere Portal resource. It is accessed during every request when analyzing the incoming URL for being a URL mapping. The size of this cache should be the number of all mappings. Creating a cache entry typically is cheap because the information often is in memory. An entry in the cache is rather small.

Tagging & Rating

com.ibm.wps.cp.tagging.TagCache

Default size: 10000, default lifetime: 3600, usage pattern: regular.

This cache stores information about tag instances. A tag instance is a single tag associated to a single resource. For example, if a single resource R1 has been tagged (by different users) with the tags T1, T1, and T3, three tag instances are being created, one that holds the information that R1 has been tagged with T1, one that holds the information that R1 has been tagged with T1 again, and one that holds the information that R1 has been tagged with T3. If another resource R2 has been tagged the same way (i.e. with the same tag names) three additional tag instances are being created that hold the information about how R2 has been tagged.

The cache scales with the number of tag instances in the system. The cache is accessed and a new entry is added whenever tag instances (not to be mixed up with tag spaces; see the TagSpace cache) for a particular resource are being queried. Thus, a reasonable size for this cache depends on the amount of tags being assigned and queried.

Depending on the usage intensity of HCL Portal's tagging capabilities a large number of tag instances can be quickly created. For instance, if a user invokes a custom tagging widget able to display all tag instances that have been assigned to a particular resource the cache might fill up quickly. One should at least try to allow for a quick reloading of such a widget when invoking it for a resource for which it has been invoked prior. Thus, to achieve best performance in terms of cache hit rate, the size should be set to a value so that all tag instances of a typical number of resources for which tags are being queried in the defined cache lifetime fit into the cache.

It might also be worth noting that the TagCache is usually less important and thus used less often than the TagSpaceCache because one is often, for the same tag (name), interested in its count only. The space cache is exactly what a tag space does – provides information about how many times a particular tag (name) has been assigned to a particular resource. For example, for a particular resource Rx it is usually only of interest how many times a tag (name) T1, T2, or Tx has been assigned; it is usually not that interesting to retrieve each single tag instance.

com.ibm.wps.cp.tagging.TagSpaceCache

Default size: 10000, default lifetime: 3600, usage pattern: regular.

This cache stores information about tag spaces. A tag space is the aggregation of tags with the same name that have been associated to a single resource. For example, if a single resource R1 has been tagged (by different users) with the tags T1, T1, and T3 two (not three as with tag instances) tag spaces are being created, one that holds the information that R1 has been tagged with T1 two times, and one that holds the information that R1 has been tagged with T3 once. If another resource R2 has been tagged the same way (i.e. with the same tag names) two additional tag spaces are being created that hold the information about how R2 has been tagged.

The cache scales with the number of tags in the system. The cache is accessed and a new entry is added whenever tags for a particular resource are being queried - in a way that tags with the same tag name can be aggregated as only their count is of interest. Thus, a reasonable size for this cache depends on the amount of tags being assigned and queried. The standard tag widgets for example access this cache frequently.

Depending on the usage intensity of HCL Portal's tagging capabilities a lot of tags can be quickly created. For instance, if a user invokes the standard tag widget (in order to query tags for a particular resource) in a short period of time and for a huge amount of different resources that all have been tagged a lot, the cache might fill up quickly. Again, one should at least try to allow for a quick reloading of the standard tag widget when invoking it for a resource for which it has been invoked prior. Thus, to achieve best performance in terms of cache hit rate, the size should be set to a value so that all tag spaces of a typical number of resources for which tags are being queried in the defined cache lifetime fit into the cache.

com.ibm.wps.cp.rating.RatingSpaceCache

Default size: 10000, default lifetime: 3600, usage pattern: regular.

This cache stores information about rating spaces. A rating space is the aggregation of ratings of the same value that have been associated to a single resource. For example, if a single resource R1 has been rated (by different users) with the values 5, 5, and 3, two (not three as with rating instances) rating spaces are being created, one that holds the information that R1 has been rated two times with 5, and one that holds the information that R1 has been rated with 3 once. If another resource R2 has been rated the same way (i.e. with the same values) two additional rating spaces are being created that hold the information about how R2 has been rated.

The cache scales with the number of ratings in the system. The cache is accessed and a new entry is added whenever ratings for a particular resource are being queried - in a way that ratings with the same value can be aggregated as only their count is of interest. Thus, a reasonable size for this cache depends on the amount of ratings being assigned and queried. The standard rating widgets for example access this cache frequently.

Depending on the usage intensity of HCL Portal's rating capabilities a lot of ratings can be quickly created. For instance, if a user invokes the standard rating widget (in order to query ratings for a particular resource) in a short period of time and for a huge amount of different resources that all have been rated a lot, the cache might fill up quickly. Again, one should at least try to allow for a quick reloading of the standard rating widget when invoking it for a resources for which it has been invoked prior. Thus, to achieve best performance, in terms of cache hit rate, the size should be set to a value so that all rating spaces of a typical number of resources for which ratings are being queried in the defined cache lifetime fit into the cache.

com.ibm.wps.cp.tagging.ResourceModelCache

Default size: 10000, default lifetime: 3600, usage pattern: regular.

This cache stores information about resources (pages, portlets, WCM content, etc.) registered with the tagging and rating engine. We refer to these registered resources as collaborative resources. A resource is being registered with the T&R engine once it is tagged or rated. This means that, at this point in time, the information which tags and/or ratings have been assigned to which resource by which user is being stored.

The cache scales with the number of collaborative resources in the system. The cache is accessed and a new entry is added whenever a resource is tagged or rated, or when particular resources are being queried, e.g. by tag names or rating values. Typical queries include queries like "Find all resources tagged with the tag T1" or "Find all resources rated with a value greater than 3". Thus, a reasonable size for this cache depends on the amount of collaborative resources being worked with. Thus, to achieve best performance, in terms of cache hit rate, the size should be set to a value so that a typical amount of collaborative resources being worked with – within the defined cache lifetime – fit into the cache.

com.ibm.wps.cp.tagging.TagNameMissCache

Default size: 10000, default lifetime: infinite, usage pattern: regular.

This cache stores information about all the tag names that have been searched for without success. It avoids costly queries for certain tag names to be carried out over and over again. This means that, in case a query for a particular tag T1 returns no results, the next query for this particular tag T1 is not being carried out again (as long as no new tags have been added as adding new tags can invalidate this cache); rather than that the result is directly served from the cache.

The cache scales with the number of distinct tags (actually tag names) that users have been searched for without success before. The cache is accessed and a new entry is added whenever a new tag is being searched for without success. Thus, a reasonable size for this cache depends on the amount of distinct tag names users have been searched for. To achieve best performance in terms of cache hit rate, the size should be set to a value so that a typical amount of tag names being searched for fit into the cache.

com.ibm.wps.cp.tagging.TypeAheadCache

Default size: 10000, default lifetime: 3600, usage pattern: regular.

This cache stores information about all the tag names that have already been used to tag resources. The set of tags being maintained as part of this cache is independent from any resource information.

The cache is primarily being used by WebSphere Portal's tagging and rating type-ahead feature. As the user starts typing a tag name, one or more possible matches for the entered text fragment are being searched for and immediately shown to the user. This immediate feedback allows users to select one of the listed options rather having to type the entire word or phrase they were looking for. A user can also choose a closely related option from the presented list. Thus, the type-ahead feature allows users to explore the tag space as they type. This can make it easier to find the correct term they want to use as the tag.

Another advantage of the type-ahead feature is that it reduces tag space littering (refer to the knowledge center for more detailed information). The cache scales with the number of distinct tags (actually tag names) in the system. The cache is accessed and a new entry is added whenever a new tag is brought into the system, or when available tags are being queried (by text fragments). hus, a reasonable size for this cache depends on the amount of distinct tag names available. To achieve best performance in terms of cache hit rate, the size should be set to a value so that all distinct tag names fit into the cache.

com.ibm.wps.cp.models.ModelCache.* (TagModel, RatingModel, ResourceModel, CategoryModel)

Default size: 200, default lifetime: 3600, usage pattern: regular.

These caches store information about the models HCL Portal's tagging and rating capabilities provide you with. There is one distinct cache for each model being provided (refer to the Knowledge Center for more information on these models):

The cache for the TagModel which is primarily used for querying tags, e.g. tags by tag names. The cache for the RatingModel which is primarily used for querying ratings, e.g. ratings by rating values. The cache for the ResourceModel which is primarily used for querying collaborative resources, e.g. resources by tag names or by rating values. The cache for the CategoryModel which is primarily used for querying categories, for example category names.

These caches scale with the number of models usually being requested . Requestors are usually components exploiting these models to implement specific functionalities. The cache is accessed and a new entry is added whenever a new model object is being requested. Thus, a reasonable size for this cache depends on the amount of components usually exploiting these models. To achieve best performance, in terms of cache hit rate, the size should be set to a value so that a typical amount of models required by exploiting components fit into the cache.

Virtual Portals

The following group of caches is only relevant if you have defined additional virtual portals in your system. In all other situations it is safe to set the size of these caches to one and the lifetime to infinite.

In HCL DX CF04, these caches were removed except com.ibm.wps.services.vpmapping.VirtualPortalIDToRealmCache. A new cache, com.ibm.wps.services.vpmapping.VirtualPortalIDAndHostnameCache, was added to support VP to hostname mapping.

com.ibm.wps.services.vpmapping.CheckForHostnameCache

Default size: 20, default lifetime: 3600, usage pattern: regular.

This cache keeps track of the hostnames used by virtual portals. If this cache is used, it could contain one entry per virtual portal, so the cache size should be larger than the number of virtual portals of your installation.

com.ibm.wps.services.vpmapping.URLToVirtualPortalIDCache

Default size: 120, default lifetime: 3600, usage pattern: regular.

This cache maps LPID values to virtual portal IDs. LPIDs are encoded in a URL that points to a certain virtual portal. Therefore the number of LPIDs is equal to the number of virtual portal IDs. Accordingly, the optimum size of this cache is the number of virtual portals defined in your environment. You may increase the lifetime for better performance if your setup of virtual portals changes infrequently. If you only use the default portal and no additional virtual portal, you will see one entry in the cache and little traffic on the cache.

com.ibm.wps.services.vpmapping.HostnameToVirtualPortalIDCache

Default size: 20, default lifetime: 3600, usage pattern: regular.

This cache ensures an efficient mapping between virtual portal ids and hostnames. If this cache is used, it could contain one entry per virtual portal, so the cache size should be larger than the number of virtual portals of your installation.

com.ibm.wps.services.vpmapping.VirtualPortalIDCacheToHostname

Default size: 20, default lifetime: 3600, usage pattern: regular.

This cache ensures an efficient mapping between hostnames and virtual portal ids. If this cache is used, it could contain one entry per virtual portal, so the cache size should be larger than the number of virtual portals of your installation.

com.ibm.wps.services.vpmapping.VirtualPortalIDToRealmCache

Default size: 120, default lifetime: 3600, usage pattern: regular.

This cache stores the realm information for virtual portals. One realm can contain several virtual portals, but one virtual portal can only be part of a single realm. As a consequence, the optimum size of this cache is the number of virtual portals defined in your environment. You may increase the lifetime for better performance if your setup of virtual portals changes infrequently. If you only use the default portal and no additional virtual portal, you will see one entry in the cache and little traffic on the cache. Creating a new cache entry requires one database query. An entry into the cache is fairly small.

com.ibm.wps.services.vpmapping.VirtualPortalIDToURLCache

Default size: 120, default lifetime: 3600, usage pattern: regular.

This cache maps virtual portal IDs to their respective LPID. The LPID usually is used to create URLs for a specific virtual portal. Since the number of LPIDs is equal to the number of virtual portal IDs, the optimum size of this cache is the number of Virtual Portals defined in your environment. You may increase the life time for better performance if your setup of virtual portals changes infrequently. If you only use the default portal and no additional virtual portal, you will see one entry in the cache and little traffic on the cache.

WebDav

com.ibm.wps.FileCache_Syncer

This is a special purpose cache that is used for the WebDAV file store. **Do not change its configuration!**

com.ibm.wps.filestore.JCRItemsCache

Default size: 5000, default lifetime: infinite, usage pattern: regular

This cache is closely related to the WebDAV file store. The content of themes and skins is stored in the WebDAV file store if this information is not contained in WAR-files.

For each file stored in the WebDAV file store, meta information, for example its administrative ID and access information is stored in the JCRItemsCache. For further information about the WebDAV file store, see the WebSphere Portal Knowledge Center.

WSRP Consumer

All WSRP caches are only accessed if the Portal is used as either a WSRP consumer or producer. Each of the caches is used on either side of the WSRP communication, but not on both sides. Most of the WSRP caches are used and read during every WSRP request, either displaying a page with a provided portlet on it, or administering WSRP properties. Exceptions to this general rule are noted below.

wsrp.cache.deleted.portlets

Default size: 500, default lifetime: 3600, usage pattern: regular.

This cache contains the handles of remote portlets that were destroyed by invoking the destroyPortlets operation. It is used on the consumer side. It scales with the number of portlet instances of remote portlets that are deleted on the consumer. The cache is used to avoid duplicate destroyPortlets requests, thus recreating the cache entry is expensive. It involves performing a WSRP request.

wsrp.cache.markup

Default size: 5000, default lifetime: 3600, usage pattern: regular.

The WSRP Consumer uses this cache to cache getMarkup responses: If Markup Caching is enabled for the Consumer or for a remote portlet, the Consumer checks this cache
before sending a WSRP getMarkup request to the producer, and sends the request only if a corresponding markup response is not found in the cache. The cache is thus
used to avoid sending WSRP getMarkup requests. The cache scales with the number of cacheable getMarkup responses received from the producer. You may adapt the cache
size. The WSRP Consumer will always override the default lifetime according to the cache expiration that is provided by the remote portlet.

wsrp.cache.portlet.descriptions

Default size: 2000, default lifetime: 10800, usage pattern: regular.

This cache contains the portlet descriptions of remote portlets. These descriptions could be considered meta information on the provided portlets, like languages and descriptions. The cache scales with the number of remote portlets consumed by the consumer. Increasing the default lifetime can improve performance if portlet descriptions of the provided portlets change infrequently. Rebuilding cache entries is rather expensive. It includes parsing the cached service description. The cached entries are rather expensive in terms of memory usage.

wsrp.cache.producer.objects

Default size: 500, default lifetime: 10800, usage pattern: regular.

This cache contains the descriptor of the producer. It is used on the consumer side. It scales with the number of producers that the consumer interacts with. Recreating cache entries is fairly expensive. It involves some DB queries and in-memory operations.

wsrp.cache.producer.user

Default size: 5000, default lifetime: 3600, usage pattern: multiple object types.

This cache contains the descriptor of the producer and context information between users and producers. It is used on the consumer side. It scales with the total number of active users accessing remote portlets of these producers, i.e the maximum the number of producers multiplied with the number of active users accessing them plus the number of producers. Recreating cache entry is fairly expensive. It involves some DB queries and in-memory operations. Therefore the session timeout should not be higher than the lifetime of entries in the cache. Cache entries are explicitly invalidated during user session destruction.

wsrp.cache.servicedescription

Default size: 150, default lifetime: infinite (-1) usage pattern: regular

This cache contains service descriptions of WSRP producers. It is used on the consumer side. It scales with the number of WSRP producers integrated into the consuming Portals; there is exactly one description per producer. The service description is generated using all the portlet descriptions from the producer Portal plus some additional data. Hence a service description can be large in terms of memory requirements. Rebuilding the description requires several roundtrips and is an expensive operation. Cache entries are rebuilt if a user clicks the 'Browse' button in the WSRP administration portlets. This leads to a refresh of all service descriptions of all producers. This cache is only used during WSRP administration.

wsrp.cache.wsrp.portlet

Default size: 2000, default lifetime: 10800, usage pattern: regular.

This cache contains the proxy portlet instances on the WSRP consumer side and is only used there. It scales with the number of integrated remote portlets multiplied with the number of users having their own customizations of portlet preferences for these remote portlets (portlet settings for legacy portlets respectively). Creating an entry for the cache involves one multi-line database query. The size of a cached entry depends on the number of parameters associated with the portlet. Hence the size ranges from small to fairly large.

WSRP Producer

wsrp.cache.event.description

Default size: 2000, default lifetime: 10800, usage pattern: regular.

This cache contains the event descriptions. These are the descriptions of events that are supported by the provided portlets. It is used on the producer. It scales with the number of events the provided portlets support. Recreating cache entries is fairly expensive. It involves some DB queries and in-memory operations.

wsrp.cache.portlet.windows

Default size: 10000, default lifetime: infinite (-1), usage pattern: regular.

This cache contains a WSRP specific wrapper on a WebSphere Portal portlet entity object. It is used on the producer side. It scales with the number of provided portlets and the number of occurrences of these portlets on consumer pages. Recreating cache entries is rather cheap and typically only includes in-memory operations. An entry into this cache is fairly small. This cache is accessed very often during a request.

wsrp.cache.portletdescription

Default size: 500, default lifetime: 3600, usage pattern: regular.

This cache contains the portlet descriptions of provided portlets. These descriptions could be considered meta information on the provided portlets, like languages and descriptions. It is used on the producer side. The cache scales with the number of portlets provided by the producer. Increasing the default lifetime can improve performance if portlet descriptions of the provided portlets change infrequently. Rebuilding cache entries is rather expensive. It includes loading data from the database with several calls. The cached entries are rather expensive in terms of memory usage.

wsrp.producer.portletpool.portlets

Default size: 5000, default lifetime: infinite (-1), usage pattern: cascading object types.

This cache stores the Producer Offered Portlets and Consumer Configured Portlets and hence scales with their number. It scales with the number of provided portlets and the number of remote users having personalized those (Consumer Configured Portlets); hence the maximum would be the number of provided portlets multiplied by the number of remote users accessing the producer. Reloading cache entries involves one query against the database. Cached entries are rather small.

WebSphere

com.ibm.workplace/ExtensionRegistryCache

com.ibm.ws.wssecurity.sctClientCacheMap

com.ibm.ws.wssecurity.sctServiceCacheMap

These caches are WAS internal caches whose size is **not** expected to be modified by customers. When viewing these caches with the Portal Cache Viewer, the following text is displayed:

This cache is not an HCL Portal cache. No recommendations are given.

LDAP/AttributesCache

Default size: 4000, default lifetime: 1200, usage pattern: regular.

VMM attributes cache to improve the performance of VMM.

LDAP/SearchResultsCache

Default size: 2000, default lifetime: 600, usage pattern: regular.

VMM search results cache to improve the performance of VMM search.

WSSecureMap

Default size: 2000, default lifetime: (Same as ltpaToken timeout. Cache entries also go away when user is logged out), usage pattern: regular.

The WSSecureMap cache stores security attributes used to recreate user credential. It scales with the number of users who log in.

In the WAS Knowledge Center, it is documented as "Security cache" in the diagram at http://www-01.ibm.com/support/knowledgecenter/SS7JFU_8.0.0/com.ibm.websphere.express.doc/info/exp/ae/csec_secattributeprop.html?cp=SS7JFU_8.0.0%2F1-8-32-2-10&lang=en.

How to Set

In the WebSphere Integrated Solutions Console
Security --> Global Secuirty --> Custom properties --> New
Create both of these security custom properties:
Name: com.ibm.ws.security.WSSecureMapInitAtStartup
Value: true
Name: com.ibm.ws.security.WSSecureMapSize
Value: <integer 100 or greater>

Miscellaneous

This group of caches does not fit in any of the other categories.

com.ibm.wps.multiviews.uri2uri

Default size: 10, default lifetime: infinite (-1), usage pattern: regular

This cache holds URIs that are expensive to parse. Its size should be equal to the number of mvc: URIs used in the theme on the main rendering path.

com.ibm.wps.services.cache.cachedstate.CachedStateServiceSessionBound.cache

Default size: 5000, default lifetime: 7200, usage pattern: typically regular.
This cache stores session-scoped data in the Portal context and is used by various Portal components. This cache scales linearly with the number of active sessions in the system and the number of Portal components using this cache for data retrieval. The usage pattern, access times, entry creation costs and entry memory sizes depend on the Portal component using this cache and cannot be stated in general.

com.ibm.wps.services.registry.ReloadableBucketCache

Default size: 32, default lifetime: infinite (-1), usage pattern: regular.

This cache is used in a cluster for Portals to notify the other cluster members when one of the registries needs to be reloaded due to administrative action. It should never be disabled or set to shared=false.

wp.xml.configitems

Default size: 100, default lifetime: infinite (-1), usage pattern: regular.

This cache stores XML Access configuration items. It is used only during XML Access processing. The entries resemble references between nodes in the XML Access document. Especially when working with complex XML files, usually used for imports or Release Builder processes, it can be beneficial to increase the cache size. The cache will be cleared after XML processing is completed. Reloading a cache entry involves one database query. Entries in the cache are medium-sized.

WCM Cache Instances

WCM Item Caching

services/cache/iwk/strategy

Default size: 2000, default lifetime: infinite (-1), usage pattern: regular.

This cache stores internal WCM items. Any WCM item read from the database will first check this cache. WCM items cover Content, Workflow, Workflow Stages, Workflow actions, Taxonomies, Categories, Authoring Templates, Presentation Templates, Sites, Siteareas, and all Library Components. The cache entry will be updated or cleared when its corresponding WCM Item is updated or deleted.

WCM Summary

services/cache/iwk/summary – WCM summaries

Default size: 2000, default lifetime: infinite (-1), usage pattern: regular.

This cache stores summaries of WCM Items. The summaries are used to display in lists in the authoring portlet or used internally in the WCM API to calculate WCM Item Document IDs used for Iterators. The cache entry will be cleared when a WCM Item is updated that will affect this summary.

WCM Basic Caching

services/cache/iwk/module

Default size: 2000, default lifetime: infinite (-1), usage pattern: regular.

This cache is used for WCM Basic caching. See the InfoCenter on setting up Basic caching. The Basic cache stores the entire response. The key is based on the URL only, so all users will see the same response.

Advanced & Resources

services/cache/iwk/processing

Default size: 2000, default lifetime: 1 month (configurable), usage pattern: regular.

This cache stores the binary MIME for file and image resources in WCM. The maximum size of resources to store is set in the WCMConfigService.properties file as the property resourceserver.maxCacheObjectSize (in kb). Resources over this size are not cached and are streamed directly to the response. The expiry is set in the same file as: resourceserver.cacheExpiryDate. The cache entry will be cleared when that resource is updated.

This cache also stores page data if WCM Advanced caching is enabled. See the HCL Digital Experience Help Center for enabling WCM Advanced caching. The processing cache stores advanced caches for the following types:

- Site: Similar to “Basic” Caching except that “Connect Tags” are processed each time
- User: Stores a copy of an item in the cache for each user
- Secured: Users that belong to the same groups will access the same cached items
- Personalized: Users who have selected the same personalization categories and keywords, and who belong to the same Group, will access the same cached items

Note that the ‘session’ option for Advanced caching is not stored in the processing cache, but the ‘session’ cache.

Session Cache

services/cache/iwk/session

Default size: 2000, default lifetime: infinite (-1), usage pattern: regular.

This cache stores the page data for when session advanced caching is enabled. See the InfoCenter for enabling WCM Advanced caching.

Menu

services/cache/iwk/menu

Default size: 2000, default lifetime: infinite (-1), usage pattern: regular.

This cache stores WCM Menu entries. An entry comprises of the Content IDs associated with a particular menu. The entries are retrieved and cached without applying security. Whenever a user needs that menu’s results, their specific security will then be applied to the cached results. A dynamic menu, which is one that is affected by the current user’s context (e.g. based on categories in a user’s profile) will store a separate cache entry for each different context. The cache entry will be cleared when a WCM Item is updated that will affect this menu.

Navigator

services/cache/iwk/nav

Default size: 2000, default lifetime: infinite (-1), usage pattern: regular.

This cache stores parent to child relationships that comprise a WCM navigator. A complex navigator might have multiple parent to child relationships (e.g. if siblings are included). The navigator entry is made up of the IDs of the parent and children. This cache will be cleared upon any WCM Item update in the system.

Absolute Path

services/cache/iwk/abspath

See description below.

services/cache/iwk/abspathreverse

Default size: 5000, default lifetime: infinite (-1), usage pattern: regular.

These two caches store JCR path to WCM item ID relationships (one cache is used for Path-to-ID relationships and the other for ID-to-Path relationships). The cache entry will be cleared when a WCM Item is updated that will affect it. Typically these two caches should be configured to have the same size.

Missed Items

services/cache/iwk/missed

Default size: 5000, default lifetime: infinite (-1), usage pattern: regular.

This cache stores JCR paths that do not exist. This is used primarily for multi-locale solutions to determine if items of other locales exist or not. The cache entry will be cleared when a WCM Item is updated that will affect it.

Project Render Information Cache

services/cache/iwk/projectrenderinfo

Default size: 100, default lifetime: infinite (-1), usage pattern: regular.

This cache stores the computed project item state information that is used to perform project rendering previews. Each project will have a single entry in the cache. The information in the cache includes the calculated relationships of draft to published items and vise- versa. This cache is used to dynamically overlay project changes over the published site. The cache entry will be cleared when WCM items are removed from projects or purged.

Legacy Cache

services/cache/iwk/site

This is an internal cache to support some old legacy capabilities of WCM. It is not used in Portal scenarios in version 8.5.

Library

services/cache/iwk/global

Default size: 2000, default lifetime: infinite (-1), usage pattern: regular.

This cache contains a lookup for library id, name and path to the library object. This is pre-populated up to the cache size at Portal startup.xmlformat

services/cache/iwk/libparent – Library Parent

Default size: 2000, default lifetime: infinite (-1), usage pattern: regular.
This cache stores a list of all children library ids to a given parent id. This was introduced for Quickr to group libraries within a teamspace.

WCI Object IDs

wci/wcmobjectids

Default size: 2000, default lifetime: infinite (-1), usage pattern: regular.

The WCI object ids cache does not have a significant effect on performance. It is used internally by the WCI consumer to ensure that concurrent distributed feed consumers do not cause inconsistencies.

User Cache

Size is fixed to 2,000. By default, this is disabled.

This cache operates using a Least Recently Used algorithm. It is not shared across nodes in the cluster and it does not use DynaCache. It does not update when LDAP changes. It is disabled by default but can be enabled through setting:

```
user.cache.enabled=true
```

How to Set

This is set in WCMConfigService.properties. To enable you need to run a module called MemberCacheManager or restart the server.

To enable the module, add the following to WCMConfigService.properties:

- connect.businesslogic.module.template.class=com.presence.connect.wmmcomms
- connect.businesslogic.module.template.remoteaccess=true
- connect.businesslogic.module.template.autoload=false

Example Scenarios

This section describes some example usage scenarios along with descriptions of possible cache settings and suggested cache sizes. This discussion may be useful as starting point for the caches in your environment.

General Comments

Most Portal caches fall into one of four groups:

1. Caches where the number of entries scales with the number of active users. For example, the access control user context cache com.ibm.wps.ac.AccessControlUserContextCache.
2. Caches where the number of entries scales with the number of users using a specific function.For example, the cache com.lotus.cs.services.directory.ldap.BasicLDAPDirectoryService.user.
3. Caches which scale with the number of pages being visited. For example, the resource cache com.ibm.wps.model.content.impl.ResourceCache.
4. Caches which scale based on the growth of some other resource, such as clients or user agents, which are stored in the cache. For example, com.ibm.wps.model.impl.RuntimeClientMap.userAgent2client.

Those that scale based on Portal resources should have lifetimes and sizes based on the number of resources in the system and how frequently users access these resources. The other caches depend upon usage scenarios such as those described in this section.

Most caches have a lifetime associated with them because the cached content might change over time. For example, access control information could be changed via user administration in the administrative portlets, XML Access or the HCL Portal scripting interface.

All code that uses caches within HCL Portal is implemented in a way such that cache entries that are no longer valid are removed from the cache if the corresponding information has been changed or deleted. So, lifetimes are not strictly needed for proper Portal functionality. However, the lifetime should still be set for the following reasons:

Expired cache entries can be removed to free up memory.

There are rare race conditions in cluster setups so that invalidation events are processed correctly but the cache still reflects wrong data.

Updates within external systems, like an external access control system, will never become visible.

If there is no or very little administration on your system and you have free memory in the Java heap available, it is safe to increase the lifetime of cache content to save the additional workload for reloading cached data.

Small Number of Pages and Small Number of Users

In this scenario a Portal has a limited number of pages and users accessing them. For example, there might be 200 pages in the system and up to a few hundred users working with the Portal simultaneously. You will find Portals of this kind often during development and testing or in smaller Portal production systems.

For Portals of this size and usage, the default cache values typically are good. So, only small modifications to the defaults should be required. Nevertheless, you should be careful not to translate those cache settings directly into production with larger user populations and more pages.

Small Number of Pages and Large Number of Users

In this scenario a Portal only offers a rather small number of pages to the user. Overall there might be only a few hundred pages, maybe with different access rights on them, so users might only see subsets of the pages. But in this scenario there are thousands of users accessing the system at the same time. In other words, thousands of users have active sessions.

Properties of caches that store information on pages typically do not need to be modified in this scenario. But all caches that store user-dependent information might be performance bottlenecks.

Assume you have 2000 active users in your system. Per-user caches being sized to only 1000 entries will operate at their upper limit nearly all of the time and constant re-calculating or re-loading of data from the Portal database will occur. You should size the user-dependent caches in a way such that enough entries for the number of currently active users can remain in memory. The number of 'currently active users' in this case are the users who have a session and still issue requests against HCL Portal. By contrast there are passive users who still have a session, but no longer issue requests and have forgotten to log out or simply went away from the screen and let the session time out.

We increased the sizes of the following five caches in our measurement environments in such a way that the data of all concurrent users fits into the caches.

```
com.ibm.wps.ac.CommonExplicitEntitlementsCache
com.ibm.wps.datastore.services.Identification.SerializedOidString.cache
com.ibm.wps.model.factory.UserSpecificModelCache
com.ibm.wps.puma.CommonPrincipalCache
com.ibm.wps.puma.OID_DN_Cache
```

We increased the lifetimes of all caches to at least one hour.

Portals with Long Session Timeouts

If the session timeout has a high value, it is likely that there will be a large number of users who still have sessions with the Portal, but who have not interacted with the site for a significant period of time. These users are known as passive users, and they can cause some special performance challenges.

In this situation the number of sessions can be very large. However, many of these sessions are 'passive'. It is typically not necessary to have all information in memory for all these users when they leave their desk but not the Portal, for example during lunch. To find proper sizes for the Portal caches you need a good understanding of the behavior of your users. Users who have not worked with the Portal for more than an hour typically will accept response times of two or three seconds for their first request after such a long break, whereas users who work with the Portal frequently do not want to see their data being evicted from caches.

For this scenario it is hard to give precise cache size recommendations. The values simply depend too much on your Portal usage scenario. You have to monitor your system and users closely to determine good values.

Portals with Many Pages

Portals in this group have several thousand pages that are available for larger groups of users. Therefore, many pages are potentially accessed quite frequently. We do not count installations with many customized pages (sometimes known as 'implicit derivations') to this group because these are private resources and are loaded for the current user only. Private data is not added to the shared Portal caches.

For example, your Portal could have 5,000 pages in total. Half of those pages are available to all users; for the other half, there are several user groups who have view rights. Some users have management rights on those pages. In this case, you typically do not want to have all pages and all corresponding information in memory at all times. But you want to make sure that all frequently accessed data is in memory. Typically, not all Portal pages are accessed with equal frequency.
We increased the sizes of the following caches in our measurement environments so that all frequently-accessed pages, can be cached.

```
com.ibm.wps.ac.CommonExplicitEntitlementsCache
com.ibm.wps.ac.PermissionCollectionCache
com.ibm.wps.ac.ProtectedResourceCache
com.ibm.wps.datastore.pageinstance.DerivationCache
com.ibm.wps.datastore.pageinstance.OIDCache
com.ibm.wps.datastore.services.Identification.SerializedOidString
com.ibm.wps.model.factory.UserSpecificModelCache
```

The lifetimes of all caches can be increased to at least one hour. The sizes com.ibm.wps.datastore.pageinstance.OIDCache and com.ibm.wps.datastore.pageinstance.DerivationCache should be large enough to hold all the pages that would be accessed in a typical day. For a production site, estimate the number of pages likely to be accessed and set these cache sizes accordingly. Remember, after adjusting any cache settings, monitor verbose garbage collection output and evaluate whether the JVM heap needs to be increased.

Listed below are the cache sizes for a site with 10,000 pages.

Table 32 Cache Manager Service Settings for a Portal with Many Pages

Parameter	Setting Used
com.ibm.wps.datastore.pageinstance.OIDCache.size	10000
com.ibm.wps.datastore.pageinstance.OIDCache.lifetime	28800
com.ibm.wps.datastore.pageinstance.DerivationCache.size	10000
com.ibm.wps.datastore.pageinstance.DerivationCache.lifetime	28800

Appendix A: Where Cache-control headers are set

This table summarizes the different places to set cache control headers on the various portal resources.

Cache	Where set
Theme Resources from the Resource Aggregator	https://help.hcltechsw.com/digital-experience/9.5/dev-theme/themeopt_mod_adminmod.html
Static theme resources that show up on urls that start with: /wps/contenthandler or /wps/mycontenthandler that portal does not deliver with cache-control headers	See Adding Cache Headers in IHS
Adaptive page caching – puts cache headers on the primary portal html response	See Adaptive Page Caching
WCM Servlet Content (not through portlet, like images, or any other direct files) /wps/wcm/connect or /wps/wcm/myconnect	See WCM browserCacheMaxAge https://help.hcltechsw.com/digital-experience/8.5/wcm/wcm_config_delivery_caching_types.html

Appendix B – References & Additional Reading

- HCL Digital Experience, Portal and Web Content Manager
  - Help Center documentation
    https://help.hcltechsw.com/digital-experience/9.5/welcome/wp95_welcome.html

  - HCL Digital Experience Benchmark Results
    Contact your HCL Sales representative
  - Performance Troubleshooting Guidance on HCL Support Knowledge Base:
    https://hclpnpsupport.hcltech.com/csm?id=kb_article&sys_id=c31616fd1bbcc09883cb86e9cd4bcbcc
- WebSphere Application Server
  - Information Center – Tuning
    https://hclpnpsupport.hcltech.com/csm?id=kb_article&sys_id=c31616fd1bbcc09883cb86e9cd4bcbcc
  - Server Performance
    https://www.ibm.com/support/knowledgecenter/en/SSEQTP_9.0.5/as_ditamaps/was9_welcome_base.html
- DB2 Information Center
  http://www.ibm.com/support/knowledgecenter/SSEPGG_10.5.0/com.ibm.db2.luw.kc.doc/welcome.html
  Oracle Documentation Index
  http://www.oracle.com/technetwork/indexes/documentation/index.html

Appendix C – Credits

Thanks to the following team members of the IBM WebSphere Portal Performance Team for contributing to this HCL Digital Experience document.

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